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AUG. 8, 1955

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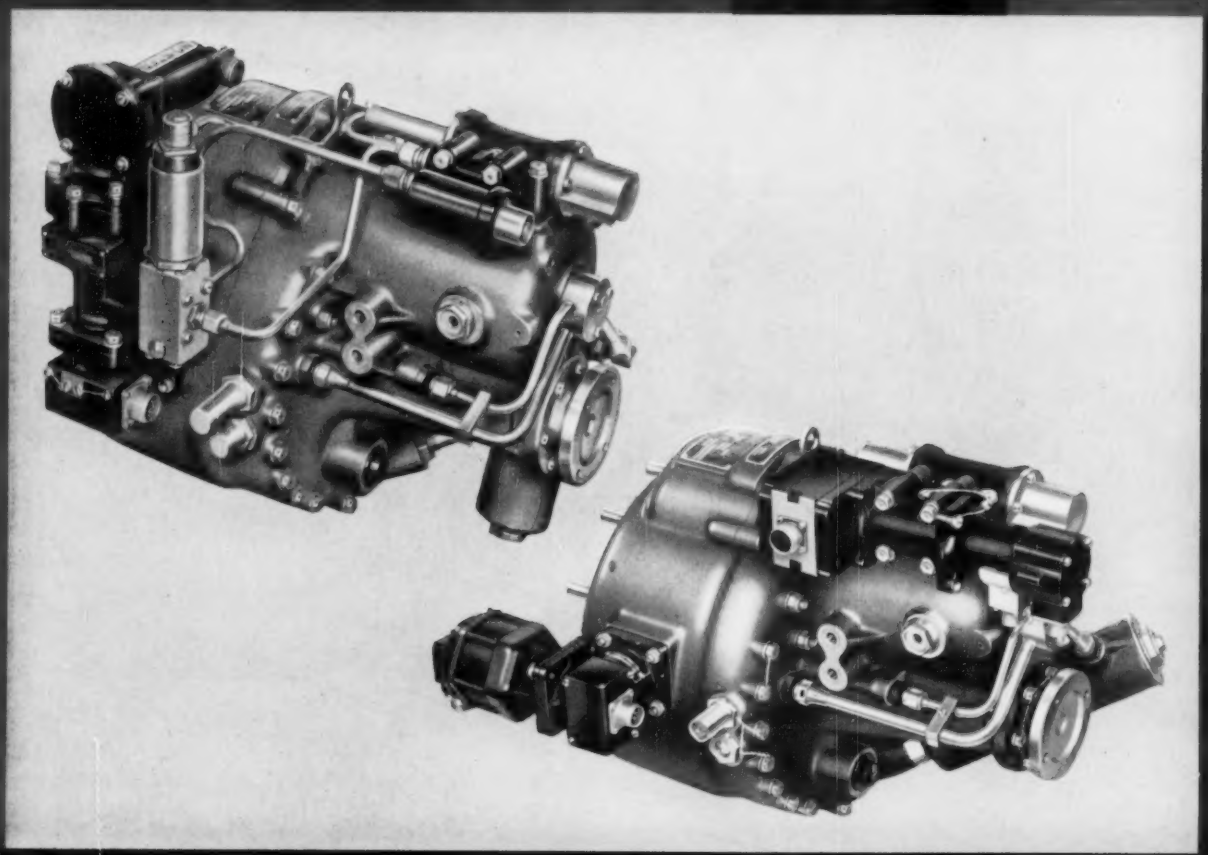

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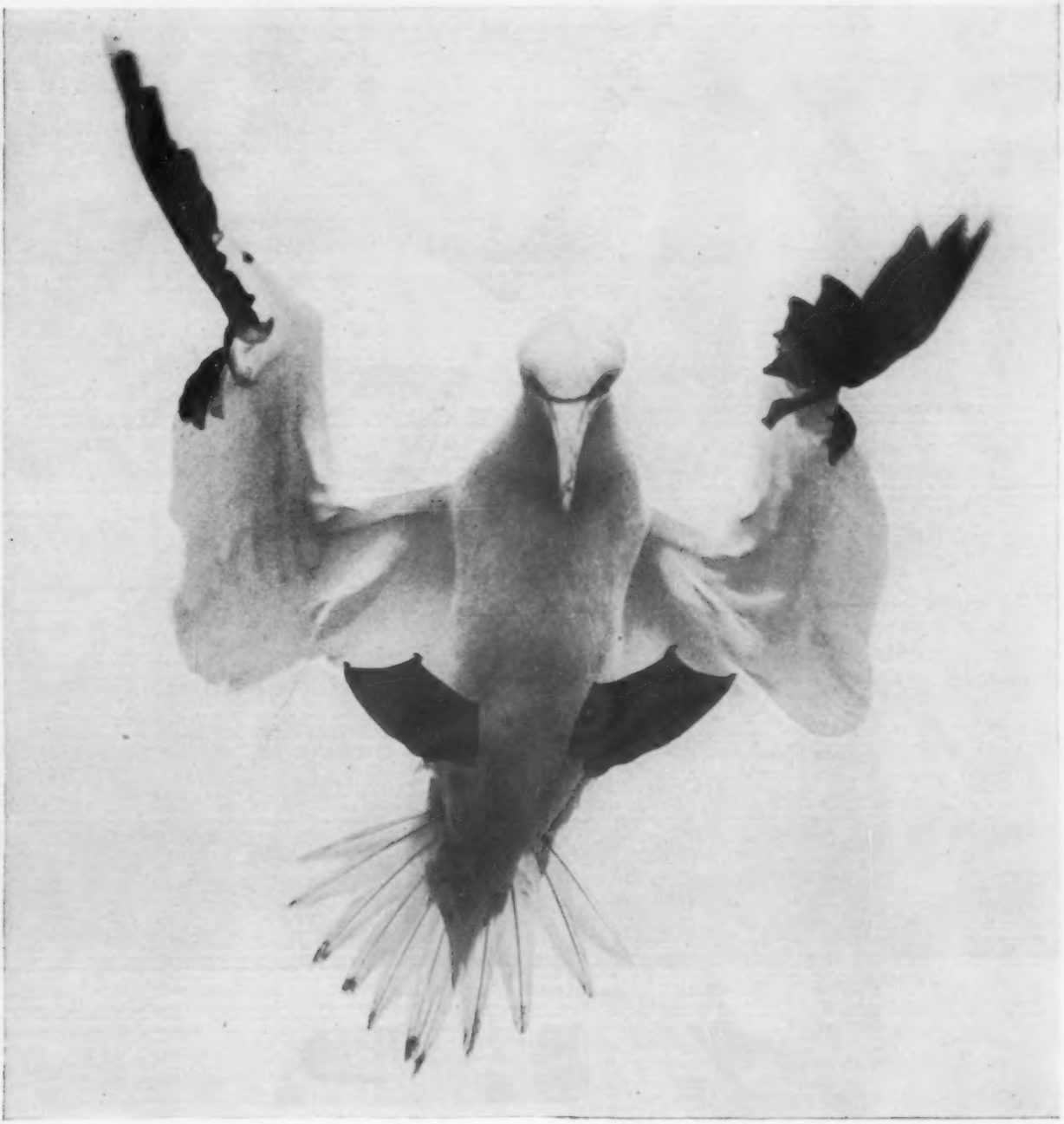

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AUGUST 8, 1955

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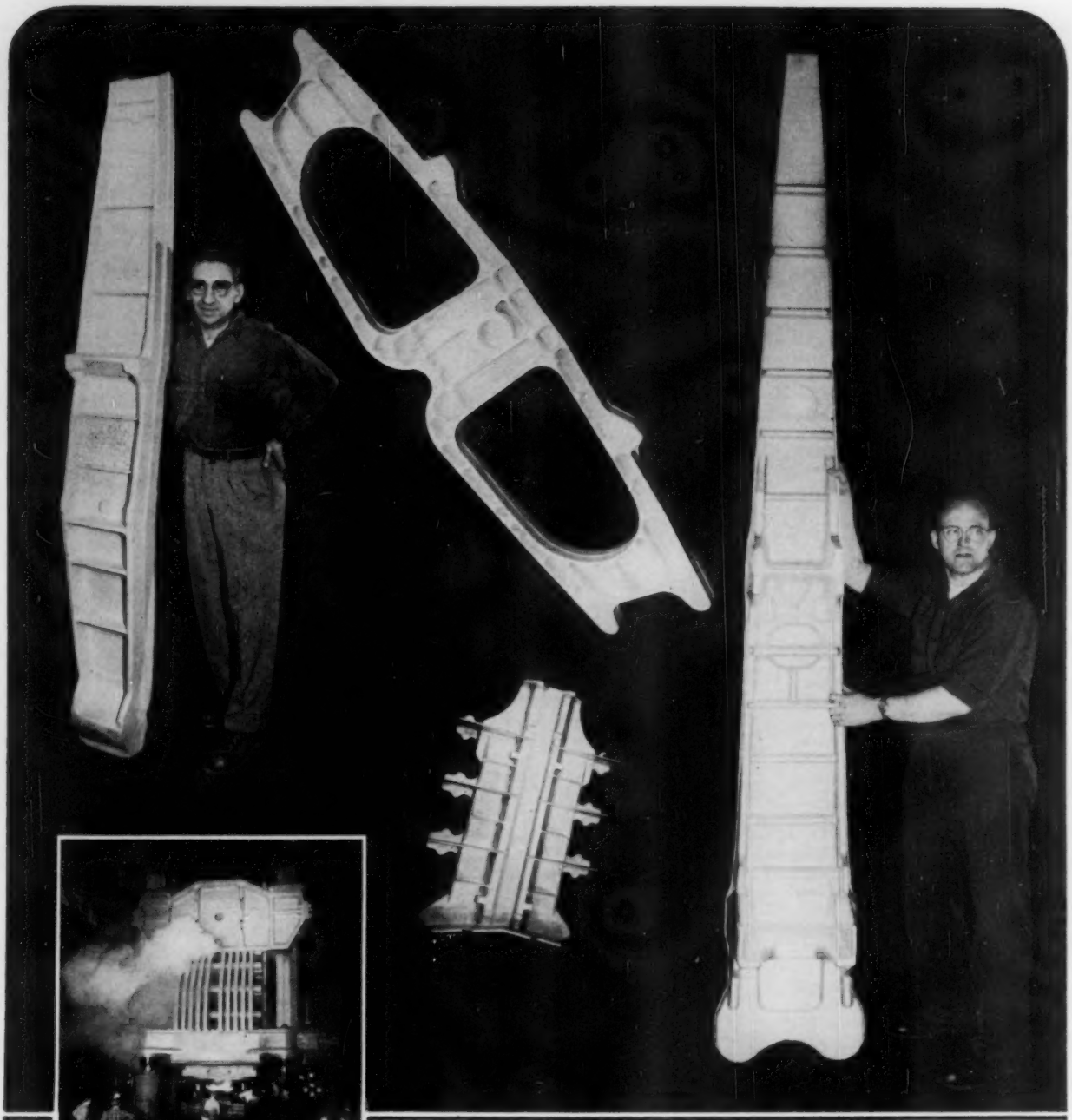

The forgings illustrated are typical of the large Aluminum Alloy Airplane parts in current production on the heavy presses at Wyman-Gordon.

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NEWS DIGEST

ANTI-NUCLEAR paint for atomic weapons carriers is shown on the belly and nacelles of this Boeing B-52 Stratofortress. Paint is designed to reflect the heat of a nuclear explosion after the long range heavy bomber makes its drop. This B-52 is undergoing flight tests at Boeing's Seattle plant prior to delivery to USAF's Strategic Air Command. Stratofortresses, equipped with eight Pratt & Whitney Aircraft J57 jet engines and aerial refueling gear, also are in production for the Air Force at the Boeing Wichita (Kan.) Division.

Domestic

President Eisenhower signed the new $232-million airport construction bill after Commerce Undersecretary Louis Rothschild reportedly advised against a veto. The new law makes $62.5 million in federal aid available this fiscal year. Airport experts estimated there is nearly $200 million in local funds available now to match federal money.

First jet transport to be certificated for commercial U. S. airline operations probably will be Boeing Airplane Co.'s Model 707 series. The firm asked Civil Aeronautics Administration last week for a type certificate on the aircraft as an initial step in approval of its airline version, saying the prototype 707 Stratoliner has accumulated 193 flight hours and meets or exceeds the overall safety level defined by Civil Aeronautics Regulation 4b. Boeing received USAF permission last month to build commercial jet transports with the KC-135 tanker, military version of the 707 (AW July 18, p. 14).

Eastern Air Lines ordered 20 additional Douglas DC-7Bs. The new order will give EAL an eventual fleet of 40 DC-7Bs. Eastern has taken delivery on five of the first 20 planes ordered, expects to receive the next 15 within 12 months and the final 20 between October 1947 October 1957 and April 1958.

Lt. Gen. Christian F. Schilt has been appointed Assistant Commandant of the Marine Corps for Air, succeeding Lt. Gen. William O. Brice.

Lockheed Aircraft Corp.'s Marietta, Ga., plant completed on schedule its first contract for Boeing B-47 spare parts. The 100% on-time deliveries involved more than 4 million individual parts.

Chase Aircraft Co., wholly-owned subsidiary of Willys Motors, Inc., has been renamed Kaiser Aircraft & Electronics Corp.

Control and test equipment for guided missiles will be manufactured by International Telephone & Telegraph Corp.'s Farnsworth Electronics Co. at Fort Wayne, Ind., under a new $10-million contract.

Financial

North American Aviation's net income for the nine months ended June 30 totaled $23,635,000, increasing sharply from $14,525,000 for the same fiscal period last year. Sales and income amounted to $580,358,025. Backlog of unfilled orders as of June 30: $1,148,109,322, compared with unfilled orders of $1,066,243,352 on March 31.

Bell Aircraft Corp. earned a net income of $3,183,978 for the six months ended July 2, compared with $3,419,584 first half of last year. Sales increased to $107,961,776 from $93,207,859. Unfilled orders as of July 2 totaled $248 million.

Boeing Airplane Co. reported net earnings of $13,635,550 from sales totaling $370,301,711 for the first half of 1955, dropping from a $17,349,618 net and sales of $496,861,262 during the similar period of 1954. Backlog of orders June 30 amounted to $1,980 million, compared with $2,131 million at the end of last year.

Chance Vought Aircraft's net income for the first half of this year dropped to $1,755,062 from $3,209,906 for the same period of 1954. Sales totaled $59,910,734, compared with $77,666,640. Unfilled orders, including letters of intent, declined to $182,700,000 on June 30 from $193,324,000 on March 31.

International

Sabena Belgian Airlines is negotiating with Russia for a route to Moscow, according to reports. Sabena would operate the proposed Brussels-Moscow route as an extension of its present service to New York.

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AVIATION CALENDAR

Aug. 15-17—Society of Automotive Engineers, West Coast Golden Anniversary Meeting, Hotel Multnomah, Portland.

Aug. 22-23—Symposium on Electronics and Automatic Production, sponsored by Stanford Research Institute and the National Industrial Conference Board, Sheraton-Palace Hotel, San Francisco.

Aug. 22-24—American Rocket Society and Northwestern University, Gas Dynamics Symposium, Evanston, Ill.

Aug. 24-26—Western Electronic Show and Convention (WESCON), Civic Auditorium and Fairmont Hotel, San Francisco.

Aug. 24-26—International Ignition Conference, conducted by Scintilla Division of Bendix Aviation Corp., Sidney, N. Y.

Sept. 3-5—Twenty-ninth National Aircraft Show, Philadelphia International Airport.

Sept. 3-9—Aircraft Owners & Pilots Assn., eighth annual Roundup Flight Cruise, New York to Bermuda.

Sept. 6-11—Society of British Aircraft Constructors, Aircraft Show and Flying Display, Farnborough, England.

Sept. 6-17—National Machine Tool Builders' Assn., Production Engineering Show and Machine Tool Show, Navy Pier and International Amphitheatre, Chicago.

Sept. 7-10—American Society of Photogrammetry, semi-annual Convention and Trade Show, Statler Hotel, Los Angeles.

Sept. 8—Airwork-Pratt & Whitney Aircraft Forum, Millville, N. J. Second forum will be held Sept. 16 in Miami.

Sept. 12-16—Instrument Society of America, Instrument-Automation Conference and Exhibit, Shrine Exposition Hall and Auditorium, Los Angeles.

Sept. 17—Institute of Radio Engineers, Symposium on Automation, Cedar Rapids, Iowa.

Sept. 17-18—Antique Airplane Assn., second annual Convention and Fly-In, municipal Airport, Ottumwa, Iowa.

Sept. 19-21—American Rocket Society, fall meeting, Los Angeles.

Sept. 21—Southwest Airmotive Engine Forum, sponsored by Pratt & Whitney Aircraft and Bendix, Melrose Hotel, Dallas.

Sept. 28-29—American Institute of Electrical Engineers and Institute of Radio Engineers, Park Sheraton Hotel, Detroit.

Oct. 3-5—Eleventh National Electronics Conference, Hotel Sherman, Chicago.

Oct. 4-6—Eleventh annual Aircraft Spark Plug and Ignition Conference, sponsored by Champion Spark Plug Co., Secor Hotel, Toledo, Ohio.

Oct. 5-7—National Business Aircraft Assn., eighth annual Meeting and Forum, Sheraton-Cadillac Hotel, Detroit, Mich.

Oct. 5-7—1955 National Airports Conference, sponsored by American Association of Airport Executives and University of Oklahoma, Norman, Okla.

Oct. 11-15—Society of Automotive Engineers, Golden Anniversary Aeronautic Meeting, Aircraft Production Forum and Aircraft Engineering Display, Hotel Statler, Los Angeles.

Oct. 17-21—International Air Transport Assn., 11th annual general meeting, Waldorf-Astoria Hotel, New York.

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WHO'S WHERE

In the Front Office

Gordon Dean, senior vice president-nuclear energy of General Dynamics Corp. Dean formerly was chairman of the Atomic Energy Commission.

Lt. Gen. Laurence C. Craigie (USAF ret.), vice president of Hydro-Aire, Inc., Burbank, Calif. Craigie was the first U. S. military pilot to fly a jet-powered aircraft, the Bell XP-59 in 1942, and became Air Force Deputy Chief of Staff for Development in 1951.

V. Charles Schorlemmer, administrative vice president of American Bosch Arma, and **L. E. Neville**, director of public relations and advertising. Schorlemmer formerly was a consultant for USAF.

Brig. Gen. Thomas L. Bryan, commander, Wright Air Development Center; **Col. Homer A. Boushey**, vice commander; **Col. E. R. Jacoby**, chief of staff; **Lt. Col. Fred C. Schmidt, Jr.**, acting chief of Electronic Components Laboratory.

Air Vice Marshal Douglas Jackman, director general of equipment, British Air Ministry. Other appointments are: **Air Commodore Maurice Lionel Heath**, director general of personnel, and **Air Commodore Geoffrey Luis Worthington**, air officer commanding Group 40, Maintenance Command.

Alonzo B. Kight, vice president of Borg-Warner International Corp., export subsidiary of Borg-Warner Corp.

Rear Adm. Robert S. Hatcher (USN Ret.), director of the Guggenheim School of Aeronautics at New York University's College of Engineering and chairman of the department of aeronautical engineering. Until his retirement, Adm. Hatcher was assistant chief of Navy's Bureau of Aeronautics in charge of research and development. He succeeds **Prof. Frederick K. Teichmann**, who will devote full time as assistant dean in charge of the College of Engineering's Day Division.

Harry A. Sosnoski, board member of Reaction Motors, Inc., Denville, N. J. Sosnoski is affiliated with Olin Mathieson Chemical Corp. as aviation advisor to the president.

Changes

Dr. Daniel W. Elam, director of the new Adhesives Engineering Division of Hexcel Products, Inc., Oakland, Calif.

Warren R. Smith, advertising director, of Fairchild Engine & Airplane Corp.; **William G. Key**, director of public relations.

Lamar W. Hart, sales director, Wiancko Engineering Co., Pasadena, Calif.

G. E. Knight, divisional secretary of aircraft division of Bristol Aeroplane Co., Ltd., Bristol, England.

Herbert C. Langenfeld, research engineer, Kaman Aircraft Corp., Bloomfield, Conn.

S. W. Beekman, manager of manufacturing, jet engine department of General Electric Co.'s Aircraft Gas Turbine Division, Cincinnati.

Martin H. Bary, district sales manager of Swissair's Philadelphia office.

Edward L. Scott, Jr., international sales manager of Slick Airways; **Arthur S. Molina**, district manager.

INDUSTRY OBSERVER

► Ryan's vertical takeoff fighter, now designated the XF-109, will be trucked to Edward's AFB this week, where first flight is scheduled for September. The XF-109 is powered by a Rolls-Royce Avon with afterburner.

► Convair has rolled out a special B-36 to carry the first airborne nuclear reactor aloft for shielding tests. Heavy shielding around the cockpit gives odd shape to B-36 nose. Otherwise, aircraft appears conventional. First flight with the reactor may take place before October.

► Piston-powered Piasecki YH-16 Transporter has finished Phase I of its flight test program, conducted at Philadelphia by pilots from Edwards AFB, Calif. During the tests, one engine cut out 15 miles from the airport and the helicopter was flown home on one engine. YH-16A, turbine-powered version of the 40-passenger aircraft, has flown 10 mins., and Phase I test flights are scheduled to start next week.

► Production plans for Avro Aircraft Ltd.'s CF-105, supersonic twin-jet fighter, have been changed. Canadian government has ordered a small monthly production of the CF-105 rather than one or two prototypes. This follows the pattern of USAF's Cook-Craigie plan which is also used now in Britain's aircraft industry. First aircraft will be powered by Pratt & Whitney Aircraft's J75 turbojet with 15,000 lb. thrust since it is not expected that Avro's PS13 Orenda engine will be ready for testing by the time the CF-105 gets into production.

► The Pratt & Whitney J57 has replaced the Allison J71-A-3 in the Northrop SM62 Snark to make space and weight for heavier guidance equipment. Snark guidance system now weighs nearly double initial design figure and takes additional fuel bay space. Although heavier than the J71, the 4,300-lb. J57's specific fuel consumption is about 20% less which decreases fuel requirements without cutting the missile's range.

► Lightweight Tacan navigation aid for business aircraft was flown last month by International Telephone and Telegraph's Federal Communications Laboratory in the company's DC-3 with "satisfactory" results. The unit, costing about $2,000 (AW June 6, p. 81), is scheduled for production in October. Declassification of Tacan is expected soon.

► Cornell Aeronautical Laboratory is doing development and test work for the wind tunnnels being constructed at Arnold Engineering Development Center, Tullahoma, Tenn. A model of Tullahoma's perforated throat is now in Cornell's supersonic tunnel.

► Cost of titanium sheet used in aircraft is about $60 per pound after figuring unrecoverable scrap losses and rejections; figure does not include labor. Present total cost of Northrop F-89 runs only $19 per pound (AW June 27, p. 9). Some contracts include a requirement that a specified percentage of titanium be used whether manufacturer wishes or not.

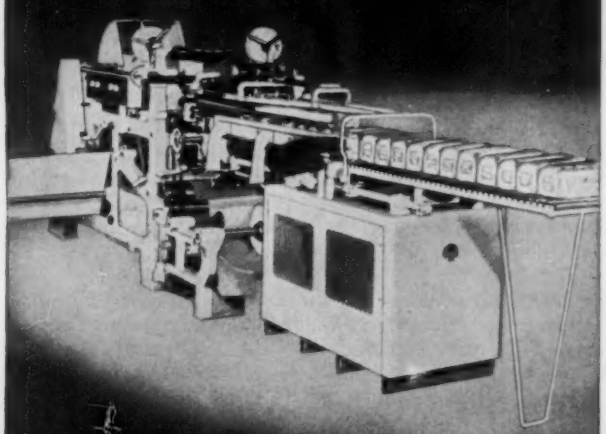
► Piasecki H-21 Work Horse helicopters are now in Alaska, carrying supplies to radar stations in the Kodiak area.

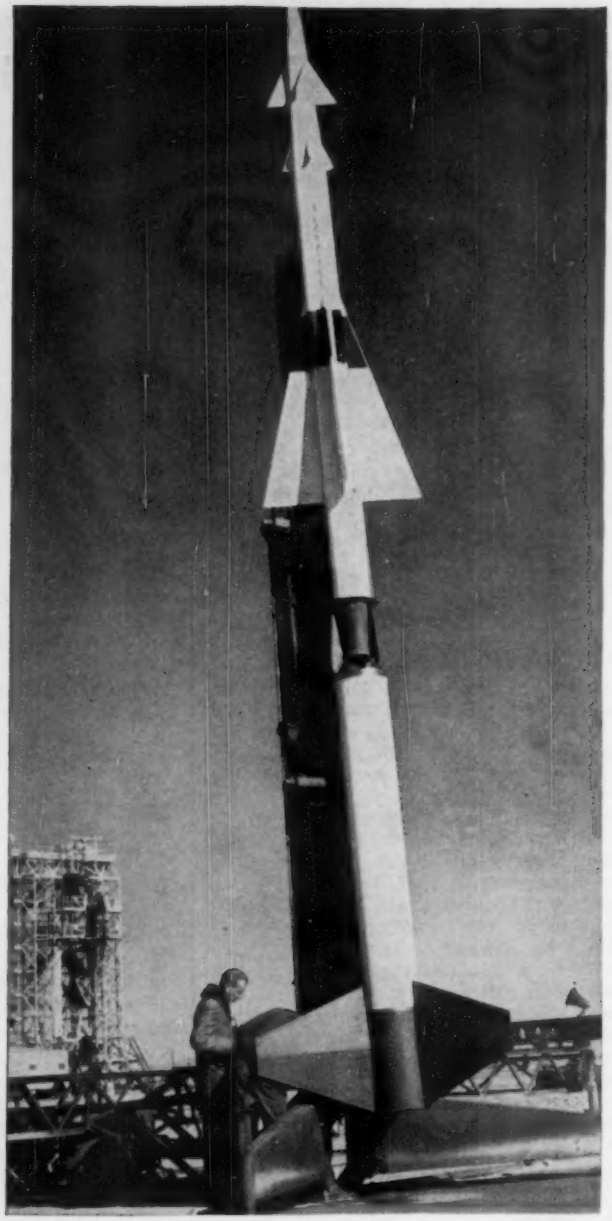
► Pilots of the 479th Fighter Group at George AFB, Calif., first operational squadron equipped with the North American F-100, report they have experienced only one flameout of the Super Sabre's Pratt & Whitney J57 engine since the aircraft was assigned to the group last year. Pilot of that aircraft glided safely back to the field.

► Lear Inc., will install an Allison T56 turboprop engine in a Learstar for testing.

► First Convair R3Y-2, bow-loading turboprop water-based transport, is to be delivered to Patuxent this month.

From wrapping bread to launching missiles...





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Washington Roundup

R & D Headquarters

Air Force is standing by its decision that headquarters for the Air Research and Development Command should be located at Wright Patterson AFB, headquarters for the Air Materiel Command. Two recent studies made under the direction of Lt. Gen. Thomas Power, research and development commander, endorse the Dayton location. One was by the commanders of research and development installations and the other by a private industrial management firm.

"Dayton is the right location," Assistant Secretary of the Air Force for Research and Development Trevor Gardner declared. "When Congress comes back in January we will make another effort to convince them of that." (See p. 18.)

Air Bilaterals

The Senate Commerce Subcommittee, headed by Sen. George Smathers (D.-Fla.), will re-open hearings shortly on the U. S.-German bilateral agreement and the facts surrounding its negotiation. Smathers has vigorously protested it, claiming the U. S. gave too much and got too little. Later the subcommittee will go into other bilaterals. A main object of the investigations: to decide whether legislation giving the Senate veto authority over executive agreements should be pushed when Congress reconvenes.

Symington on Talbott

USAF's first secretary, Sen. Stuart Symington, tried, but didn't succeed, in keeping out of the controversy over USAF Secretary Harold Talbott, a personal friend. Symington's sole original comment: "He has done a fine job for the Air Force."

Subsequently, however, Oregon Sen. Wayne Morse pointed to Symington's speeches critical of the Administration's air power program as evidence that "even on the basis of Mr. Talbott's record as Secretary of the Air Force, he ought to be dismissed irrespective of his indiscretions."

Symington explained his original brief comment: "What I had in mind was just this: Secretary Talbott presented with ability and energy to the Congress the case for an expanded Air Force."

Army Air Control

U. S. Army continues to move quietly in the direction of more independent control over its aviation. Newest move is organization of Board No. 6, Continental Army Command. It is a new development and test agency for aircraft located at Camp Rucker, Ala., home of the Army Aviation School. Activity formerly was under CONARC Board 5, which embodied communications, electronics and airborne equipment as well as flying hardware. Move is consistent with establishment early this year of separate Army Aviation Division of G-3, headed by Brig. Gen. H. H. Howze.

CAB and Congress

Republican recognition of continually strained relations between Congress and the Civil Aeronautics Board led to the newly created CAB post of Congressional Liaison Officer, which has been filled by Rod Kreger, 33, former member of the GOP National Committee staff. Although most CAB squabbles with Congress have been ironed out since Ross Rizley became Board chairman this year, Kreger is expected to maintain improved communications between the regulatory agency and its parent body. Major complaint of lawmakers in the past has been with the Board's delay and evasiveness in answering inquiries as well as poor preparation for hearings. Kreger, who will report directly to Rizley, served as secretary to Rep. H. O. Lovre (R.-S. Dak.), and later at the Department of Agriculture.

Wilson's Order Ignored

Defense Secretary Charles E. Wilson's order directing the armed services to replace generals and admirals with civilians as chiefs of their public information offices (AW Apr. 4, p. 11) has been quietly ignored.

Last week the Navy, handicapped for many months by the fact that Rear Adm. William G. Beecher, Jr., chief of public information, has been ill, named another admiral to replace him. New chief is Edmund B. Taylor, Pacific destroyer hero and Annapolis football star of the early 1920's. Indications are that Adm. Taylor, who has served in the Pentagon as an aide to both the Secretary and Under Secretary of the Navy, will move in with minimum fanfare and no mention of the fact that Mr. Wilson once demanded that his chair be filled from outside military circles.

Meanwhile, the Army soon must make a decision along the same line. Its top PIO, Maj. Gen. Gilman C. Mudgett, is being moved to a new command at Fort Ord, Calif. His deputy, Brig. Gen. T. S. Riggs, temporarily will head the public information offices.

Third military man who was supposed to move out under the Wilson order is Brig. Gen. Robert Lee Scott, USAF. He had been on his job only a few days when the Defense Secretary clamped down, has managed to continue with considerable success and win his first star in the interim.

ASPR Revision

Defense Department is maintaining silence on aircraft industry's sweeping criticism of the proposed revisions to Section XV of the Armed Services Procurement Regulation (AW July 4, p. 14). Indications are that meeting to discuss differences will not be held until vacations are over, probably in early October. Meanwhile, the aircraft industry is eager to learn the attitude of Dudley C. Sharp, who will replace Roger Lewis as Assistant USAF Secretary for Materiel on Oct. 1, toward cost allowability of compensation plans involving profit cuts and stock bonuses. Lewis looked on such costs with a cold eye, viewed many as contractual atrocities. Industry hopes Sharp "will be more realistic."

Aircraft Investigations

The plan now of two congressional committees—House Appropriations Subcommittee on the Armed Services and House Armed Services Investigating Subcommittee—is to put off hearings on profits of aircraft and other defense contractors until the new session next January. Staff work will be completed during the recess. "What the staff comes up with will determine what we will do then," Rep. George Mahon (D.-Tex.), chairman of the Military Appropriations Subcommittee, said.—**Washington staff.**

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Air Force Eliminates Design Studies

Aircraft firms will be chosen for Phase I contracts on basis of performance to speed new developments.

By Claude Witze

Washington, D. C.—U. S. Air Force has revised its weapons system procurement procedure to eliminate preliminary design studies, substituting Phase I contracts with a small number of hand-picked aircraft companies.

To the U. S. aircraft industry this means increasing emphasis will be placed on past performance, know-how, the availability of engineering effort and current work load. On the basis of these factors USAF will decide which companies will be invited to design weapons systems and procure mockups for evaluation.

USAF introduced the new procurement philosophy last week when it awarded Phase I development contracts to six manufacturers for three different types of aircraft, a long range interceptor, a fighter-bomber and a tactical bomber.

In the case of the long range interceptor, a design competition was held and recommendations were sent to the Air Staff by the Air Research and Development Command and the Air Materiel Command.

However, no decision was reached on the basis of the "paper designs." Result was awarding of Phase I contracts to three firms.

Advantages Cited

USAF is confident the revised program will attain these goals:

- **Conserve engineering** manpower by eliminating eight to twelve design studies, most of which never result in hardware.
- **Compress development** cycle of new weapons. This is a field in which Russia has made tremendous strides, coming up with improved aircraft much quicker than anticipated by aircraft experts in the U. S.
- **Improve chances** of obtaining a good product that will fill USAF's mission.
- **Save money:** Some USAF officers have been making no secret of the fact that picking a weapons system from paper proposals has resulted in growing design and development headaches, higher costs and degenerating relations with the industry.

"The new approach," one of them told AVIATION WEEK, "is to see the colt, not place the bet from the racing form."

Industry Reaction

While the new system will not call for flying prototypes, company representatives hailed the USAF decision as a step in the right direction. There has been growing dissatisfaction with the procedure of awarding production contracts for a single design prior to flight of a prototype.

"The competitive system is by far the best," one company official told AVIATION WEEK, "but is possible, of course, only during a period of reduced world tension when it is not necessary to rush promising designs into immediate production without a competitive test."

The decision no longer to tie USAF to paper proposals is not expected to have any effect on utilization of the Cook-Craigie plan to speed output once the weapons system is ready for production.

The effort in eliminating design studies is to compress development time, the field in which USAF has been feeling pressure from its Red air force rivals.

Indications that a change in procurement policy in the design and development stage have been mounting in recent months.

Specialization Factor

In an interview with AVIATION WEEK, Roger Lewis, retiring Assistant Secretary of Air Force for Materiel, said last fall that tougher competition was ahead for the aircraft industry, with increasing emphasis on the individual firm's past performance (AW Nov. 15, p. 13).

Later, in testimony before a subcommittee of the House Committee on Appropriations, Lewis placed emphasis on the specialized nature of airplanes and the companies who design and make them.

"We have about 12 airframe companies which have the engineering organization and production resources with which to design and develop an airplane," Lewis told the House committee.

"But even among those 12 companies there is a high degree of specialization which limits the field.

"For example, we have only two companies which have had experience in and have the competence to develop heavy bombers. We have three or four companies that can develop fighters. And we have some other companies that can develop transports and cargo planes.

"So among the 12 there are only two or three that really compete directly with each other on specific items."

This conviction, it was clear last week, has led USAF to discard the system under which a dozen firms compete on preliminary design work, wasting a great deal of the nation's scarce engineering talent, without producing an item of mockup hardware for evaluation.

Lewis played a major role in the decision to change the procurement policy.

He was assisted in this by the new Deputy Chief of Staff for Materiel, Maj. Gen. Clarence S. Irvine, former deputy commander of AMC for production.

New Jet Engine

Westinghouse Aircraft Gas Turbine Division has completed a 50-hour endurance run on its new PD-33 axial flow turbojet in the 6,000 lb. plus thrust class.

The PD-33 is a privately developed Westinghouse design aimed at a military market for medium-powered, high efficiency engine with low frontal drag area. Westinghouse officials said the PD-33 had met its specified thrust and fuel consumption figures on the 50-hour run.

Senate Approves Sharp

The Senate unanimously confirmed the appointment of Dudley Sharp, Houston oil equipment manufacturer, as Assistant Secretary of the Air Force for Materiel.

He succeeds Roger Lewis, whose resignation becomes effective Sept. 30 (AW July 25, p. 15)

It is understood that Sharp was recommended by Robert Anderson, a fellow Texan, who recently resigned as Deputy Secretary of Defense.

Long Range Interceptor Contracts Among New Policy's First Awards

By William J. Coughlin

Los Angeles—Air Force awarded six development contracts last week for three different types of aircraft—a long range interceptor, a fighter-bomber and a tactical bomber.

Phase I preliminary design and mock-up contracts went to North American Aviation, Northrop Aircraft and Lockheed Aircraft Corp. for the long range interceptor. Republic Aviation and North American received similar contracts for a fighter-bomber, and Glenn L. Martin and Douglas Aircraft were awarded development contracts for a tactical bomber.

Final Air Force decision on the new series of aircraft will await evaluation of the mockups.

In the case of the long range interceptor, USAF has been considering design studies submitted many months ago by a number of weapons system contractors. The fighter bomber and tactical bomber will be new aircraft and the aircraft companies selected for Phase I contracts do not have concrete proposals at the present time.

Here are the winning entries in the long range interceptor competition:

- **North American** submitted an advanced version of its forthcoming F-107, originally designated the F-100B and designed for Mach 2 speeds. While the NAA proposal is similar to the F-107 it is regarded as a "practically new airplane."
- **Northrop design** is its so-called Delta Scorpion, a delta-wing F-89.
- **Lockheed proposal** is an entirely new straight-wing design. It is not a version of the much lighter F-104.

Air Force specifications for the new interceptor call for Mach 2 speed and a combat radius of 1,000 miles. The heavy two-place aircraft would weigh about 60,000-70,000 lb.

Outdate Requirements

Designated mission is that of a bomber-destroyer designed to intercept and shoot down enemy strategic aircraft, rather than to intercept other fighters. The long range interceptor will be armed with air-to-air missiles.

No decision was disclosed on the avionics fire control and navigation equipment to be used.

With specifications unchanged since the request for design proposals was made in the fall of 1953, Air Defense Command is said to believe the performance outlined for the new LRI aircraft does not fill the requirements for the time period in which it would become operational. This indicates that evaluation of latest Russian aircraft has placed their performance much higher than previously anticipated.

One industry source predicted that while the contract design studies are being carried out, a requirement will be reached for a higher performance airplane and re-submitted to industry. He said it is unlikely that any of the three interceptor entries will ever be built in quantity.

F-101 Voodoo's Role

Air Force is going ahead with plans for a larger version of McDonnell Aircraft Corp.'s F-101 Voodoo as an interim long range interceptor to meet defense requirements within five years.

While the Voodoo was undergoing flight tests at Edwards Air Force Base, an observer from a rival company described it as a "good aircraft which is flying well."

Large enough to have the range needed, the modified F-101 will be able to carry the best fire control equipment available. This aircraft can be operational within three years, according to estimates, in time to meet a critical period in the balance of strength between U. S. and Russian airpower.

First place in the technical evaluation of the long range interceptor proposals went to Lockheed, with Boeing Airplane Co.'s Wichita Division a surprise second by a margin of only six points. Boeing may have been left out of any contract award due to a feeling that it is now fully occupied in the jet bomber, tanker and transport fields.

Convair Division of General Dynamics Corp., once a very hot entrant in the competition with a version of the B-58, cannot be regarded as entirely washed out of the long range interceptor picture by award of the three contracts.

The B-58 is scheduled to fly by the fall of next year and, while reliable sources report that this first aircraft will be only an "aerodynamic shell," it could enter into the final Air Force interceptor decision.

In commenting on reports that new planning is being held up to study missile developments now entering the picture, one source said: "It will be a manned airplane; I've yet to talk to anyone in the Air Force or industry who is foolish enough to believe a missile will do the job."

Among important factors working in favor of the F-101 and against any decision to build a prototype were:

- **Intelligence reports** indicating the Russians will have a supersonic bomber fleet operational in the 1960's, which would make the performance of this interceptor of marginal value.
- **Need for an aircraft** to meet the Red threat in the period prior to 1960.
- **Inability of the avionics industry** to provide fire control and guidance equipment to match the speed of the interceptor at the time it originally was scheduled to start in production.
- **Lack of powerplant** required by the high-performance aircraft.
- **Realization that designs** in the competition were hampered by a fighter-interceptor requirement that was unnecessary.

"Air Force had always assumed that this aircraft would tangle with other fighters," said a top airframe official. "It was implied in the specs, and the designs therefore compromised the job of bomber-destroyer."

An aircraft intended to defend the continental United States from Soviet bombers at a distance of 1,000 miles from U. S. borders will not have to combat enemy fighters, he said.

"USAF finally came to the realization that the need is for a bomber-destroyer, not a fighter-interceptor. All the competitors in the industry knew this all along, but we just didn't face up to it."

Many top Air Force officers now believe a more pressing need is for an aircraft that can defend the U. S. against bombers prior to 1960.

Such an aircraft will not have to be a Mach 2 airplane since the great majority, if not all, of the Red bomber fleet will be subsonic in the period.

Modification of an existing aircraft could meet these requirements.

The aircraft best equipped for this task is the F-101, according to USAF.

Weapons Lab

The establishment of a new weapons Guidance Laboratory at the Wright Air Development Center, Wright-Patterson Air Force Base, Ohio, through the expansion and reorganization of the former Armament Laboratory was announced last week by the Air Research and Development Command.

The Weapons Defense Branch of the new laboratory takes over the activities formerly assigned to the Aerial Reconnaissance Laboratory and the Bomber Defense Branch of the Armament Laboratory. Other branches whose work has been integrated into the new laboratory include the Guidance Development branch of the Aerial Reconnaissance Laboratory and the Communications Navigation Laboratory.

Satellite Only in 'Planning Stage;' Aircraft Industry Not Consulted

Washington, D. C.—Interest of the U. S. aircraft industry in the earth satellite program planned for the International Geophysical Year, 1957-1958, is academic.

Purpose of the project is scientific. Aside from propulsion units to carry the satellite nearly 300 miles above the earth's surface, nothing in the plans will involve contracts for design, prototype or production hardware.

A spokesman for the National Science Foundation told AVIATION WEEK it would be "premature" to consult the aircraft industry on the construction details. The spokesman said the propulsion system probably will be purchased by the Defense Department with a conventional contract, but indicated that production of the satellite itself will be on a laboratory basis, aided by component manufacturers where necessary.

The satellite program, announced at the White House, contains a long list of unknowns and is based on the assumption that some government, university or private laboratory will produce designs that appear feasible and qualify for the "go-ahead to participate," using funds set aside for IGY projects.

Reasons for Release

Major significance of the satellite announcement last week appeared to center on these points:

- **It brought international public attention** to the IGY program, involving interchange of scientific information among 40 nations.
- **It confirmed feasibility** of the satellite idea. Presumably recent developments in rocket propulsion have made the program more practical than it was in 1948, when the late James E. Forrestal, then Secretary of Defense, disclosed that the armed forces were conducting research on the subject.
- **It was designed to offset** concern over the strong possibility that Russia is ahead of the U. S. in the race to launch a satellite. Moscow announced in January 1954 that the project was feasible and in April of this year said top Red scientists were working to perfect a design. In Copenhagen last week a Soviet expert declared their aim is to have a vehicle in space within 18 months, or about six months before the American effort is expected to materialize. If they succeed, the pattern will follow that of Russian advances in aircraft, which have been faster than predicted by Administration experts.

Information on the U.S. effort to launch a satellite during the IGY, given out by top executives of the National Science Foundation, the National Academy of Sciences and the National Committee for the IGY, disclosed that so far the vehicle remains an idea, "only really in the planning stage."

'Just Don't Know'

Here are the facts revealed by the scientists involved:

- **Although there is no design** and no plans to obtain one unless it is voluntarily offered, it is assumed that the first satellites will be about the size of a basketball. Speed, material and instrumentation, if any, are undetermined.
- **Flying around the earth** once every 90 minutes at 18,000 miles an hour, it will gather and broadcast information from the ionosphere and upper atmosphere only if it is instrumented. If it lacks instruments the only thing that will be learned is a measure of the density of the atmosphere nearly 300 miles above the earth. This will be calculated by clocking how fast the satellite is slowed down by drag.
- **The scientists "just don't know"** anything about the size and construction of the missile to propel the satellite. Two-stage rockets have been shot up to 250 miles, using the German-developed V-2 as the prime carrier. That was in 1949 and there has been no announcement of a superior U. S.-developed missile. Aerojet-General Corp., Azusa, Calif., claims it could get a 50 lb. vehicle 200 to 400 miles above the earth (AW July 11, p. 14).
- **Cost of the program** is as uncertain as the design, although a figure of $10 million has been used, exclusive of the propulsion system. Provision of the rockets and actual launching of the vehicle is the only part of the project that will be in the hands of the Defense Department. Defense will pay the bill, which easily could be more than another $10 million.
- **The scientists do not know** whether or not their early experiments will lead to a larger satellite, possibly carrying a crew and possessed of military capabilities. The Air Force is conducting studies on the medical problems involved in such a possibility.
- **Results of the U. S. program** will be shared with the 40 nations participating in the IGY schedule, including Russia. An additional reason for international co-operation is the fact that once a satellite is launched anyone within line of sight can watch its progress with a telescope.

First news of the project came from Brussels, Belgium, 22 minutes before the White House announcement. In Brussels, the American program was disclosed by Prof. Marcel Nicolet, executive secretary of the Special Committee of the International Geophysical Year.

Soviet Satellite Progress Hinted

Russia's top rocket specialists are hinting at rapid progress in the USSR's crash program for solving space flight problems. Statements published in the Soviet press shortly before President Eisenhower's announcement of U. S. plans for building and launching a small earth satellite during the International Geophysical Year, 1957-1958, exude optimism regarding the possible success of far more ambitious projects.

N. Varvarov, chairman of the Astronautics Section of the USSR's Central Aviation Club, writing in the authoritative publication "Soviet Fleet," said flatly that a multi-stage rocket powered by chemical fuel can now be built for a one-way flight to the moon. He added that a round-trip flight to the moon by a rocket using only chemical fuel will be possible in the near future, if an artificial earth satellite can be used as an intermediate fueling station.

Varvarov described a feasible multi-stage moon rocket as one having a turbo-compressor in the first stage, a ramjet engine in the second and rocket engines in the third and subsequent stages. He continued:

"Since the exhaust velocity increases with the temperature in the combustion chamber, being roughly the square root of that temperature (this means that thermal intensity in the combustion chamber is extremely high and the work period of the engine is consequently short). Then the big advantage of the multi-stage rocket over the single-stage rocket is obvious. The advantage is that each section's engine can be speeded up in its work—forced to work a short time under high thermal tension in its combustion chamber.

Fuel Savings

"Fuel savings also can be achieved if the rocket rises straight up. This allows it to pass through the lower and denser layers of the earth's atmosphere more quickly. Also, the faster the rocket rises, the less fuel will be needed for it to reach the required speed.

"If due consideration is given to the above factors, plus other ones that help reduce the amount of fuel needed to reach the necessary speed, it is possible today to build a multi-stage, one-

way moon rocket operating on chemical fuel."

He said the possibility of using atomic energy in jet engines opens up new vistas for solving the problems of interplanetary flight and suggested two types:

"The first would use the energy of nuclear reactions to raise the temperature of any working medium—gas, liquid or molten metal. Temperature of hydrogen can be raised to several thousand degrees by this method with resulting gas outflow speed of up to 12 kilometers (39,500 ft.) per second. With this gas outflow speed, the initial weight of a round-trip moon rocket would be ten times its final weight. This weight ratio is acceptable since the weight ratio of present rockets is already about five to one.

Further Study

"The second type of nuclear engine would obtain its propulsive force directly from the flow of particles formed during nuclear reactions and moving at speeds of several thousand kilometers per second."

Russian scientists are "tirelessly" struggling with space flight problems, Varvarov added. He noted that the USSR Academy of Scientists recently established the Tsiolkowsky Gold Medal for outstanding achievements by Soviet scientists in the field of interplanetary flight. A permanent interdepartmental commission on interplanetary travel, attached to the Astronomical Council of the USSR Academy of Sciences, has been organized to coordinate and guide all work connected with the task of conquering cosmic space.

The Astronautics Section of the USSR Central Aviation Club, which Varvarov heads, has among its members a number of outstanding Soviet scientists and engineers engaged in Russia's rocket and space flight programs.

McDonnell Sales Up

McDonnell Aircraft Corp. last week reported record sales and earnings for the fiscal year ending June 30.

The company reported sales of $154,588,816, up $31,497,125 from the previous year, and earnings after taxes of $4,555,795, an increase over last year of $934,378. This amounts to $6.33 per common share compared with $5.03 for the previous year.

Backlog, however, dropped from $441,371,868 to $305,438,023. The company said that a large increase in the backlog is expected within the next four months.

Largest order, McDonnell reported would be from USAF for the F-101 Voodoo.

Talbott Quits Post Under Pressure

By Katherine Johnsen

Washington, D. C.—Harold Talbott, apparently with reluctance resigned last week as the Air Force's third secretary, effective Aug. 13, after a dogged fight to hold the post.

During the past year, Talbott achieved considerable popularity in Congress for aggressively pushing the USAF program, sometimes with little cooperation from Secretary of Defense Charles Wilson, and among USAF personnel for his fight for benefits.

Almost to the moment he submitted his resignation to the President, Talbott publicly insisted that he had no intention of resigning. He dissolved his partnership in the New York management firm, Paul B. Mulligan & Co., after telling the Senate Subcommittee on Investigations that he had been "mistaken" in promoting business for the firm from his Pentagon office (AW Aug. 1, p. 13).

'Within Bounds of Ethics'

In his letter to the President, Talbott said he was resigning "because I would not in any circumstances wish to be a source of embarrassment to you, or to your splendid Administration."

He pointed out that to become Secretary of the Air Force he "gladly" divested himself of substantial stock holdings, "for it was an inspiration to me to be found worthy of assuming the office I have held." Talbott added:

"The recent unfortunate and, I believe, distorted publicity given to my continued association with a management engineering firm has been a matter of deep concern to me. Before the Senate confirmed me, it agreed to my retention of this interest. I am clear in my mind and conscience that my actions have been within the bounds of ethics. This connection has never influenced me, or interfered in the slightest with the discharge of my responsibilities as Secretary of the Air Force, and I have never used that office to further its business."

In his letter promptly accepting Talbott's resignation, the President commended him for his "tireless energy" and "unexcelled" performance in administration of the Air Force. The President further observed:

"As a result of public inquiry into your personal business activities, I realize that you have been subjecting yourself and your position to a most severe and searching scrutiny. I, like all others who know you, have been sure that your ultimate decision would ignore any personal desire or inclination and would demonstrate your devotion to the Air Force and your concern for the security of our country.

"Your decision to resign, of course, has been a difficult one for you because there has been no intimation that your official duties have not been effectively and loyally performed. Nevertheless, I feel that, under the circumstances, your decision was the right one, and I accept your resignation."

Asks Further Investigation

Oregon's Sen. Wayne Morse (D.) unrelentingly attacked Talbott up to the adjournment of Congress. Morse proposed that Talbott violated the "letter" as well as the "spirit" of conflict-of-interest statutes.

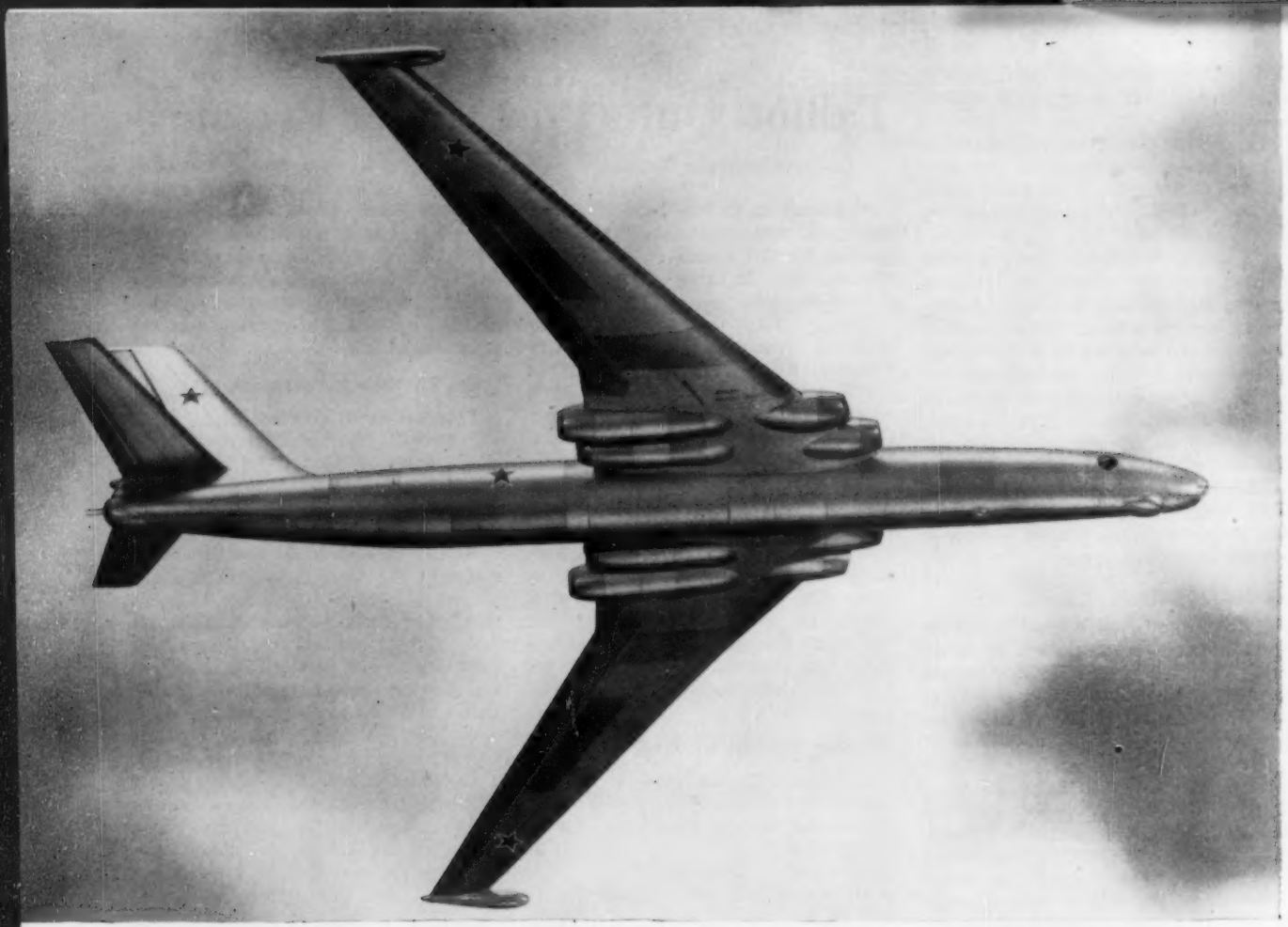
Morse, with the backing of Sen. Estes Kefauver (D.-Tenn.), has called for a further investigation into Talbott's method of stock disposal on taking office. Talbott testified that he gave his 2,000 shares of Chrysler Corp. stock to his four children and sold his 15,000 shares of Standard Packaging Co. stock and 8,000 shares of Electric Auto-Lite Co. stock on the open market.

Outlook is that the Talbott matter will be put to rest with a report by the Senate Investigating Subcommittee critical of the "ethics" of Talbott's private business activities while serving as secretary. But Sen. John McClellan (D.-Ark.), chairman of the subcommittee, has not completely closed the door, stating only that "there is no immediate probability" of new hearings.

Democratic Sen. Dennis Chavez (D.-N. Mex.) volunteered a speech in Talbott's defense before the question as to whether he should continue as USAF Secretary was decided. Under questioning, Chavez, Chairman of the Appropriations Subcommittee on the Armed Services, remarked that he thought that Talbott had been "indiscreet," but praised his performance as secretary.

Three leading prospects to succeed Talbott are:

- **James Douglas, Under Secretary of the Air Force.** A highly respected Chicago attorney, Douglas, 56, served as an officer in the Army Air Force during World War II.
- **Rep. Carl Hinshaw (D.-Calif.).** Although he is second ranking Republican on the House Commerce Committee, Hinshaw is understood to be willing to surrender his congressional seniority for the USAF post, should it be offered. Hinshaw is a close associate of Secretary of the Navy Charles Thomas.
- **H. Lee White,** who served as Assistant Secretary of the Air Force for Management during the first year of the Eisenhower Administration. He resigned for salary reasons and returned to the New York law firm, Cadwalder, Wickersham & Taft.



Bison Details Shown by Navy Model

First design details of the Bison, Russian inter-continental turbojet bomber, are shown in this official recognition model built from collated intelligence data by the Special Devices Center, Office of Naval Research.

Features of the Red bomber not previously disclosed by pictures of the plane in its several public appearances over Moscow include:

• **Bicycle landing gear** like the Boeing B-52, with outrigger gear in wingtip pods.

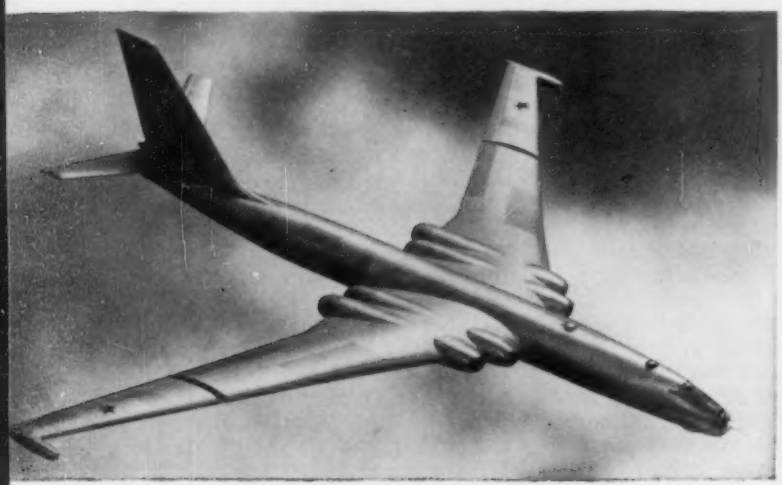
• **External fuselage** dorsal and ventral turrets, sighting blisters, radomes and antenna, indicating a lower state of the avionic art in Russia than here.

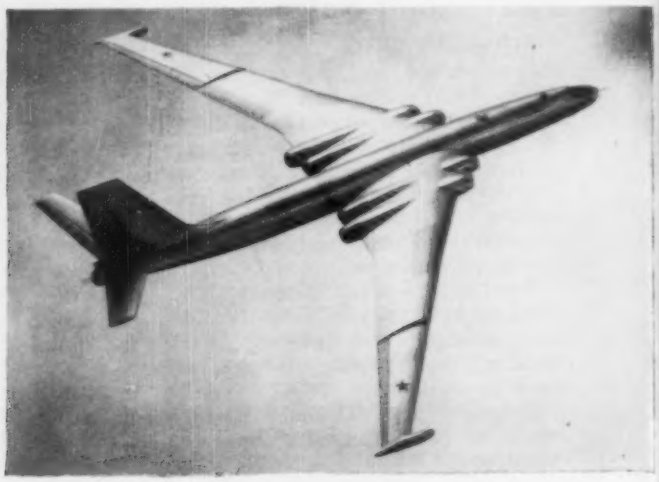
• **Conventional control** systems for all three axes, in contrast to the spoilers, split rudders and other schemes used in contemporary U.S. aircraft.

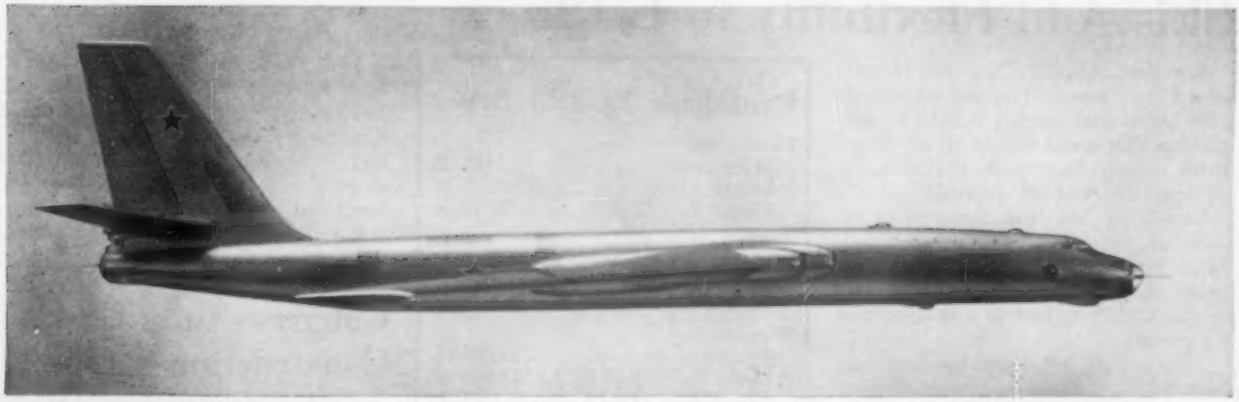
• **Canted intakes** for the 18,000-lb. thrust turbojets to allow for air inflow near the fuselage and the inboard nacelle; exhausts of inboard nacelles are toothed to improve flow characteristics.

Aerodynamic Layout

Bison's wing is cranked slightly at the leading edge, with the greater degree







of sweep inboard. Thickness tapers unevenly, too, with higher ratios inboard of the wing crank.

The Navy model shows a single main spar, with auxiliary spars at the leading edge and ahead of ailerons and flaps. Ailerons and flaps appear to be about 20% of wing chord; flaps are single slotted type.

A single boundary-layer fence is fitted to the top of each panel just inboard of the aileron root.

The fuselage is elliptical in cross-section. The belly line is straight, interrupted by a ventral turret and a chin bombing radome. The upper fuselage line is a long, graceful curve, bending downwards at each end and giving the cockpit a drooped appearance. Forward of the turret positions, the fuselage also tapers in planform.

Vertical and horizontal tails are swept and have the geometry characteristic of Ilyushin's latest designs. Rudder has a very wide chord, contrasting with the much-smaller chord of the elevators.

The tail turret has windows, and is shown occupied in the model above. It is a radome typical of remote-control turrets.

Indication of production breaks on the Navy model point to the unitized construction of wing center section and bomb-bay areas. The wing outer panels attach just outboard of the outboard nacelles rather than at the break in the trailing edge.

Skis Add Flexibility to C-123

Stroukoff Aircraft Corp. has mounted a C-123 assault transport on retractable hydro-skis, turning it into an amphibian that could free U. S. Air Force battle supply lines from the necessity of operating out of airports.

Sacrificing less than three miles an hour of the aircraft's cruising speed, Mike Stroukoff, president of the company, claims he has opened up most of the world's surface as a landing area for aircraft.

This covers not only the seas and lakes but surfaces covered by snow, sand and shallow swamps.

The new landing gear, called Pantobase, was developed under contract for the Air Research and Development Command. It consists of two heavily-stressed hollow skis that can be folded into the belly of the aircraft during flight or operation on conventional gear from an airport.

Other modifications to make the Pantobase YC-123E include a pontoon on each wing, strenghtening and watertight treatment for the bulky plane's fuselage and a slight reduction in the diameter of the Hamilton-Standard propellers.

Blade Thrust Cut

The props were changed to provide clearance when the aircraft is taxiing on water.

Stroukoff said blade thrust has been cut from approximately 9,500 lb. to about 8,000 lb. Conventional transport version of the plane, the C-123B, is being manufactured by Fairchild Aircraft Division, Hagerstown, Md.

At a demonstration of the Pantobase plane in Philadelphia, Stroukoff told AVIATION WEEK he has an USAF contract for six more aircraft. These will combine the hydro-ski landing gear with boundary layer control features currently being tested on another prototype, the XC-123D at Stroukoff's plant in Trenton, N. J.

Adoption of the Pantobase idea to other USAF transports so that they can take advantage of terrain flexibility is limited only by basic design, according to ARDC spokesmen.

Fuselage Rebuilt

The hydro-ski can be put on any high-wing plane where the propellers can clear the water and the aircraft's belly can be modified to be watertight and stable while floating.

In the case of the C-123, the redesign of the fuselage did not interfere with the spaciousness of the interior or the straight-in tail loading ramp.

The YC-123E is the same aircraft that Stroukoff first flew in the late 1940's as a glider. Later four General Electric J-47 jet engines were installed and it became the first jet-propelled cargo plane. For the Pantobase experiment, the entire lower half of the fuselage was rebuilt in addition to adding the wing tip floats.

Pantobase YC-123 Specs

Dimensions:	
Wing span	110 ft.
Length	77 ft. 2 in.
Height	32 ft. 10 in.
Areas:	
Wing	1223.2 sq. ft.
Horizontal tail	309.2 sq. ft.
Vertical tail	179.5 sq. ft.
Weights:	
Weight empty	34,000 lb.
Design useful load	18,600 lb.
Design gross weight	52,600 lb.
Capacities	
Cargo	14,100 lb.
Troops	61
Cargo compartment dimensions:	
Length	36 ft. 8 in.
Width	9 ft. 2 in.
Height	8 ft. 2 in.
Performance:	
Cruising speed	179 mph.
Range	1,500 miles
Take-off, water	1,400 ft.
Take-off, land	800 ft.
Landing, water	750 ft.
Landing, land	1,050 ft.

YC-123E supply plane designed to operate from water and unprepared landing strips.

Congress Cuts USAF Construction Funds

The $1,078 million approved for Fiscal 1956 construction at Air Force installations is $122 million less than USAF's $1.2 billion request.

Congress, on two controversial items, took these actions:

- **Eliminated $6 million** for a new headquarters building for the Research and Development Command. There was general agreement on the requirement for the headquarters. But congressmen were skeptical of USAF's plan to locate it at Wright-Patterson AFB, Ohio. Senate Armed Services Committee has directed USAF to reconsider.
- **Voted $20 million** for USAF's new Air Force Academy, only a fourth of the $79 million USAF requested. Congress decided that "preliminary" construction could move forward while USAF decides on the architectural design. The ultra-modernistic design originally planned by USAF provoked much widespread protest.

USAF's $1,078 million was the major portion of the total $2,005 million Congress approved in new money and transfer funds for Fiscal 1956 military construction.

The Army was voted $485 million; Navy, $442 million.

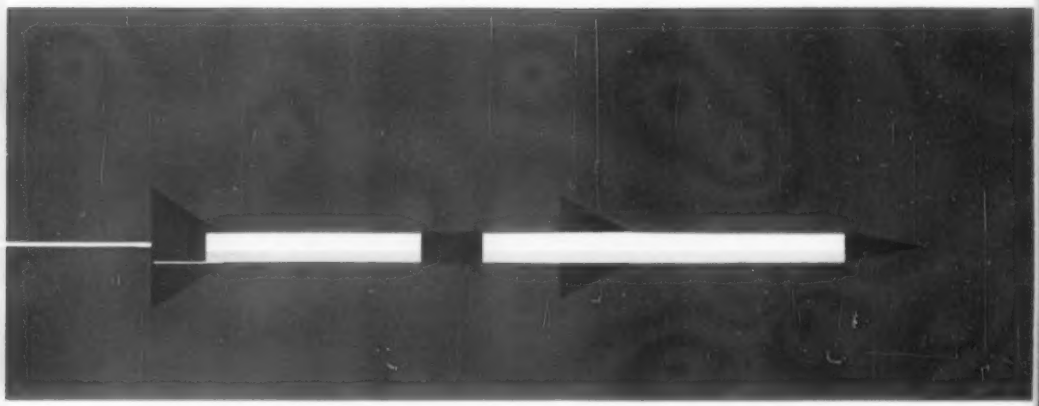
The $268 million cut from the total $2,273 million asked by the three services was divided: USAF, $122 million; Army, $60 million; Navy, $86 million.

Major projects in the USAF program include:

- **Air Defense Command:** Greater Milwaukee areas, $16.6 million.
- **Air Materiel Command:** Griffiss AFB, N. Y., $15.8 million; Wright-Patterson AFB, $13.6 million.
- **Research and Development Command:** Arnold Engineering Development Center, Tenn., $15.5 million; Hartford, Conn., research facility, $22.4 million.
- **Military Air Transport Command:** Charleston, S. C., AFB, $10 million.
- **Strategic Air Command:** Clinton Sherman, Okla., AFB, $10.2 million; Dow, Me., AFB, $15 million; Ellsworth, S. Dak., AFB, $12.4 million; Plattsburgh, N. Y., AFB, $22 million; Portsmouth, N. H., AFB, $24.8 million.

Guiding or intercepting

Research, development, production of electronic computers for defense



Today our Armed Services are making valuable use of Burroughs Corporation applied research for analysis and study of original defense concepts; of our expert engineering for development and testing of prototypes; and of our mass-precision manufacturing facilities for final production of defense appliances.

Burroughs' defense accomplishment embraces the fields of instrumentation, control systems, communications, magnetic and electronic components and electronic computers. It is marked by achievements like the A-4 Gun Sight, the Skysweeper "brain," ground guidance computers for high-priority systems and other classified projects. Address inquiries to Burroughs Corporation, Detroit 32, Michigan.

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The first machine to give you either AC or DC current at the flip of a switch.

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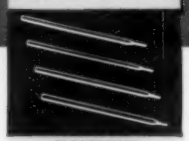

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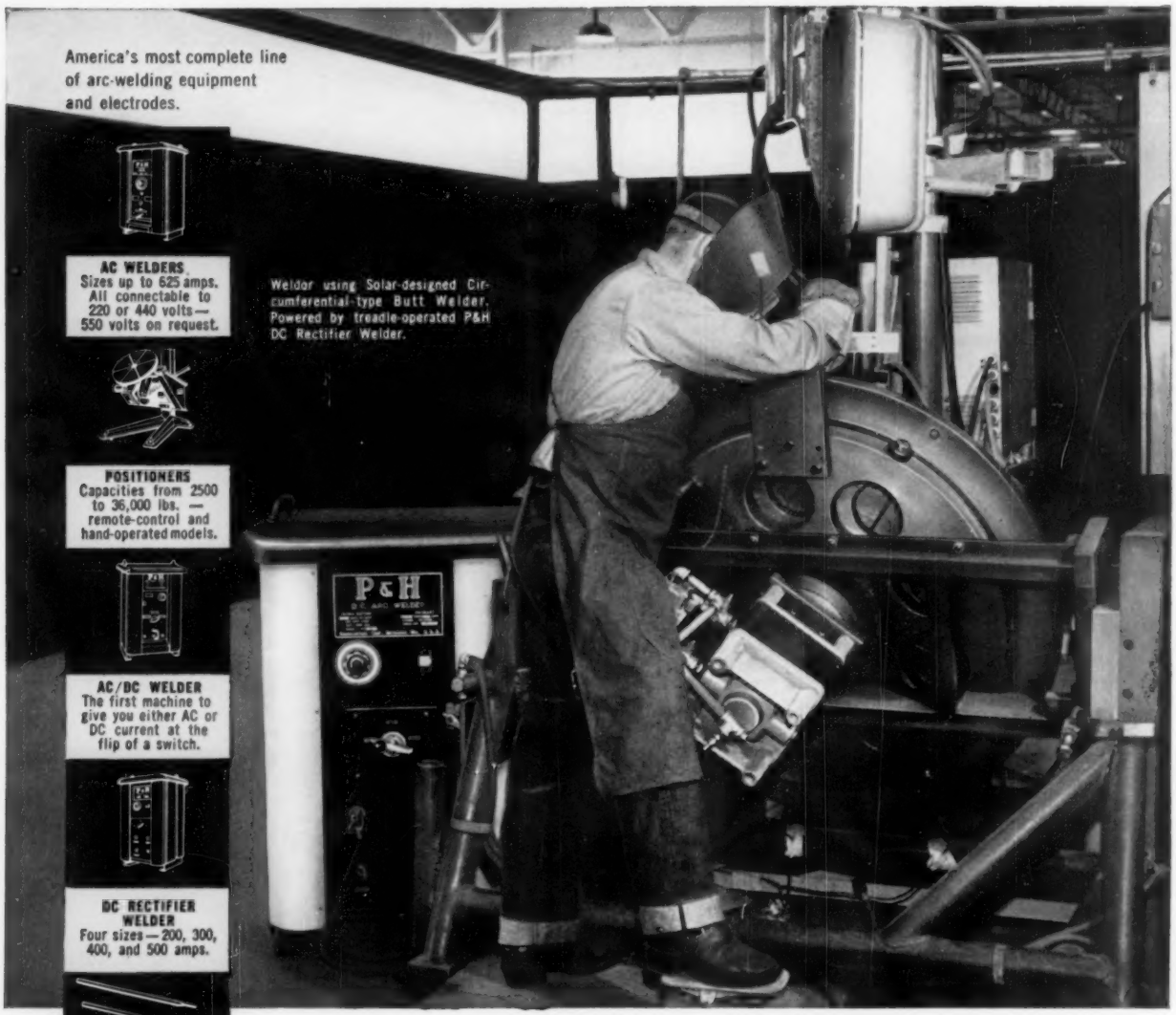

Welder using Solar-designed Circumferential-type Butt Welder. Powered by treadle-operated P&H DC Rectifier Welder.

Butt-welding .0015" stainless now an every-day job at Solar Aircraft

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WELDING a tiny diaphragm of ultra-thin .0015 stainless steel could be a real problem. But Solar Aircraft at San Diego does this delicate job with standard P&H welders — in fact, the same welders it uses for fabricating 28-foot diameter, wind-tunnel expansion joints.

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One Year to Air-Survey Russia

President Eisenhower's Geneva proposal that the United States and Soviet Russia conduct aerial reconnaissance of each other's military establishments last week was viewed as a challenge to aerial photographers as well as diplomats.

The mass of Communist real estate that would have to be covered includes:

- **8,500,000 square miles in the U.S.S.R.**
- **200,000 square miles in the satellite states.**
- **4,314,000 square miles in Red China.**

Though this area was not specifically mentioned in the Eisenhower program, the accelerated buildup of Red air power there in recent months makes the Far East of growing importance in the world military picture.

Sherman M. Fairchild, a leading U.S. expert on aerial reconnaissance and head of Fairchild Camera and Instrument Corp., said last week that Soviet Russia itself could be covered in a year's time with 34 modern planes of the B-47 type.

With all this work, he added, hidden underground installations and uranium stockpiles would not be disclosed in this type of high-altitude survey work. Two principal complications are:

- **Uranium stockpiles** can be uncovered only by an aerial scintillometer, which must be flown at 400 feet altitude and then covers a width of only a quarter of a mile.
- **The instrument is useless** over snow-covered areas.

The high-altitude job of surveying Russia with 34 planes would depend, Fairchild said, on the availability of planes such as the B-47 equipped with T-11 or T-12 cameras. Each plane would cover about 4,000 square miles per flying hour.

Weather, he anticipates, would give the mission only 30 flying days in the year, during which each aircraft, flying at 500 miles an hour, could photograph a strip eight miles wide and 500 miles long.

Fairchild said that the cost of mapping Russia commercially would be more than $40 million. With Air Force equipment and personnel this bill could be cut to about $15 million. The complete job would have to be done because there are no existing accurate aerial maps of Russia.

On the other hand, expense to Russia of mapping the United States could be cut substantially by the fact that almost 95% of our country already has been photographed and mapped.

Fairchild also pointed out that aerial reconnaissance of the U.S. and Russia would have to be on a continuing basis to keep the information current and inspire confidence in the program.

If the coverage includes the satellite Communist countries and Red China another 19 aircraft will be needed in addition to the 34 for Russia to complete the job in a year.

The most practical approach, Fairchild said, would be to use vertical photographs and make up mosaics to ease the identification of factories and installations. If more detail is needed, a larger scale picture would be required.

Fairchild pointed out that if we want a real topographic survey from which it would be possible to make accurate maps, more complexities would be introduced and the job will take many years. Lack of accurate maps is a known complication in research work on guidance systems for missiles.

In this connection, Fairchild said, the essential piece of mapping equipment is a stereoplanigraph. To the best of his knowledge there are only 150 of these devices in the world and most of them are in Russia, having been captured from Germany in World War II. There are about 20 in the U.S.

Scottish Twin Pioneer Starts Tests

New 16-passenger Scottish Aviation Twin Pioneer transport is designed to operate from small airports. At 13,500 gross weight it takes off in 300 ft. and needs only 180 ft. for landing ground run. Stall speed is 47 mph. Engines are two 570-hp. Alvis Leonides.

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IGNITION
ACCESSORIES

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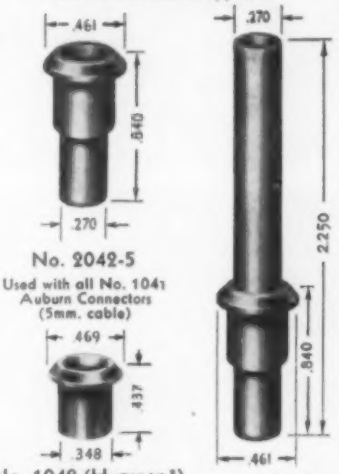

No. 2042-5
Used with all No. 1041 Auburn Connectors (5mm. cable)

No. 1042 (Hypreen*)
No. 1043 (Silicone)
Used with all No. 1041 Auburn Connectors (7mm. cable)

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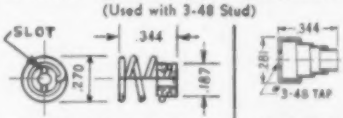
*Auburn Synthetic Rubber

SPRING AND EYELET ASSEMBLIES
(Used with 3-48 Stud)



No. 1066-9A (AN 4164-22) with stainless steel coil springs

No. 1066-9V with Inconel volute springs

Teflon Connectors
with Inconel volute springs

1041-TV (9/16")
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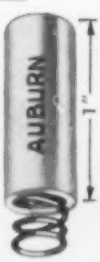
Connectors with stainless steel coil springs

1041-C Steatite
1041-M Mycalex
1041-D Alumina
(AN 4164-2)

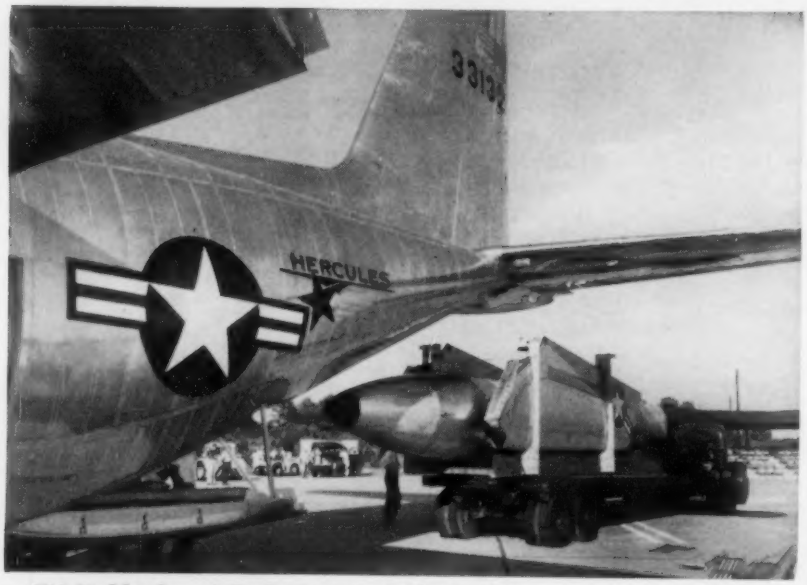
1099-C Steatite
1099-M Mycalex
1099-F Phenolic
1099-D Alumina
(AN 4164-1)



1041 1099

AUBURN SPARK PLUG Co. Inc., Auburn, N.Y.

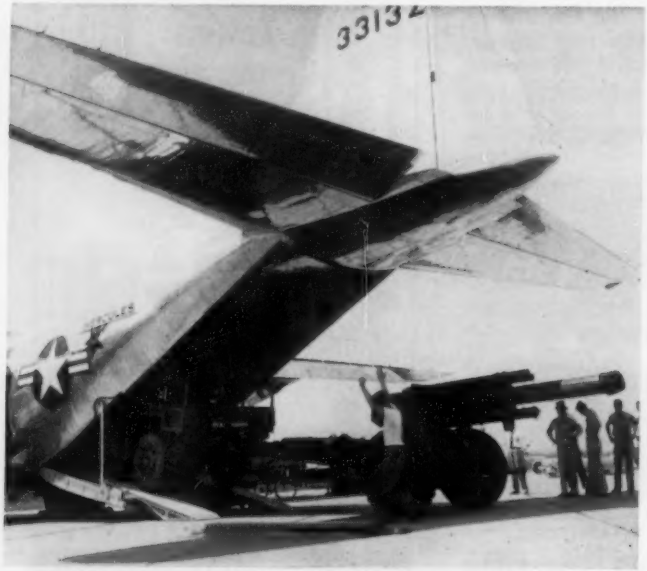
HERCULES' cargo doors are open for air dropping supplies to Army troops.



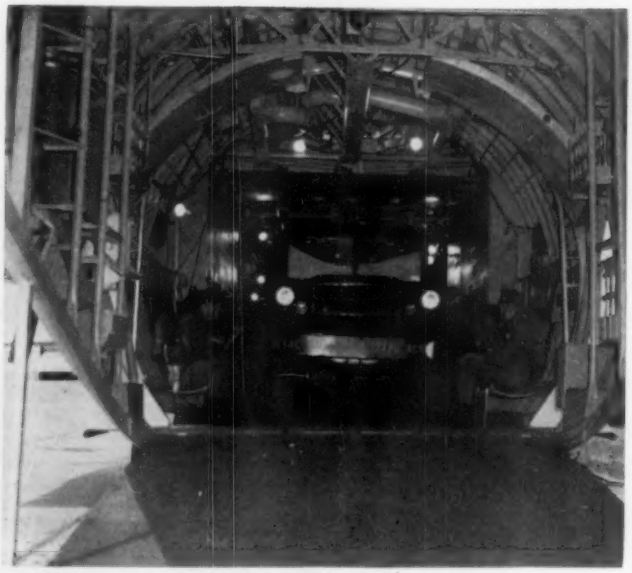
TM-61 Matador missile fits into the C-130 for delivery to a TAC launching site.

LOCKHEED'S turboprop Hercules increases global

C-130 Adds Versatility to TAC Airlift



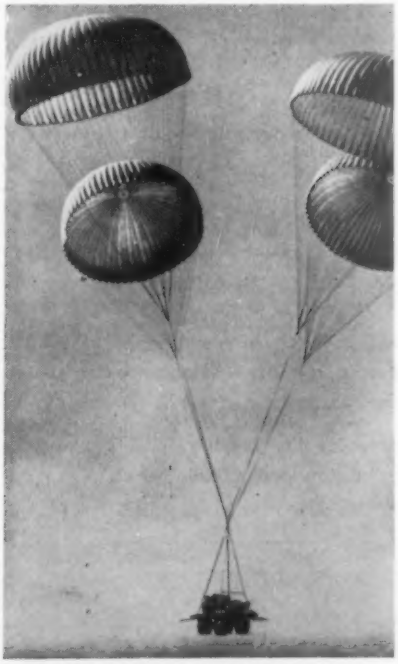
CARGO DOORS open up and down with bottom section becoming ramp up which truck is drawing an Army 155 mm. howitzer.



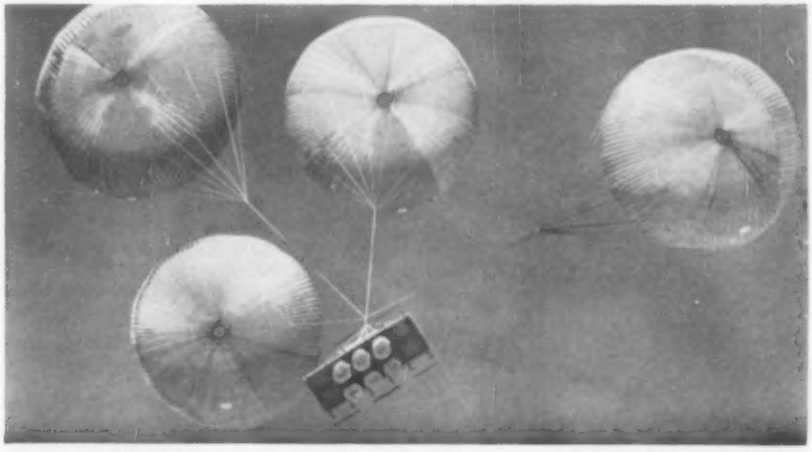
CARGO interior is shown from rear. A TAC aircraft warning team is loaded. Pressurization permits high altitude flights.

capability of Tactical Air Command to move U. S. Army troops and equipment and TAC's own strike force such as this 5,000-gal. tanker.

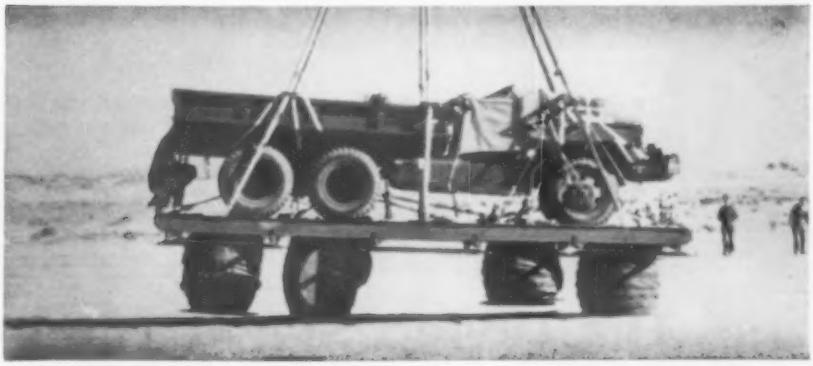
Air Delivery System Parachutes Heavy Equipment Swiftly, Gently



TWENTY TONS OF SUPPLIES can be parachuted from a C-130 Hercules in a few seconds using delivery system developed by Lockheed in cooperation with Firestone Tire and Rubber Co. and Brooks & Perkins Inc. Equipment and supplies are firmly fastened to aluminum alloy or magnesium platforms which an extraction chute drags from the aircraft.



FOUR PARACHUTES keep the cargo-loaded platform reasonably level for safe landing.



AIR-FILLED BAGS made by Firestone cushion the impact. Bags fill automatically.

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- **High Natural Frequency**
- **Available in Rate Ranges From 40°/Sec. Up.**

Motor excitation	26 or 6.3V, 400 Cps.
Damping	as required
Starting time	15 seconds
Resolution	well below earth's rate
Dynamic range	100,000:1
Linearity	0.1% to half scale
Nominal Full Scale Output	5.6 Volts
Oper. Temperature Range	—55° to +85°C

Rugged construction enables this gyro to withstand a wide range of environmental conditions in accordance with military specifications.

Performance characteristics of the Gyro can be modified in event one of our standard models does not fulfill your specific requirements.

During the past 14 years U. S. Time has produced more than 327,000 gyroscopes of various types at peak rates of 17,000 per month.

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AA Traffic Record

American Airlines carried more than 686,000 passengers approximately 416 million passenger-miles during June, claimed as a new world's record for airline traffic during the month.

In reporting the record last week, AA Senior Vice President-Sales C. R. Speers said the number of passengers represented a 12.4% increase over June 1954 and the passenger-miles a 13.2% gain.

Airfreight traffic increased 28.5%, to more than 6 million ton-miles from 4.6 million during the same period last year.

Congressmen Question CAB 'Entry' Policy

Two congressmen have pressed House Commerce Committee to open a review of Civil Aeronautics Board's administration of the 1938 Civil Aeronautics Act.

• In a session with the committee, Rep. Hale Boggs (D.-La.) urged the committee to give particular attention to CAB's policies on new entry into air transportation.

• Rep. Chet Holifield (D.-Calif.), meanwhile, in a speech on the House floor called on the committee to specifically investigate CAB's decision ordering North American Airlines to cease operations.

"I feel that there is no question but that there has been a violation of the Civil Aeronautics Act," Holifield observed, "but I am not certain as to who has been the violator, considering the economic hobbles laid down by the CAB. There may be a technical violation by the North American Airlines, but in terms of the broad interests of the CAA act, we have prima facie evidence that the Board has flouted the interests of Congress and clearly perverted its power to foster a government-protected monoply by courtesy of the federal government."

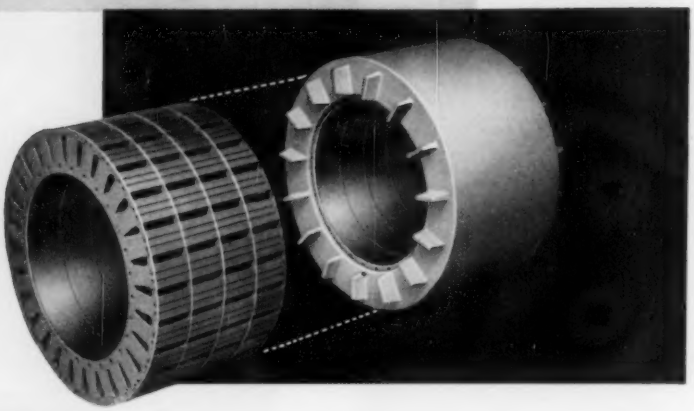
NAA Traffic Up 47%

Burbank, Calif. North American Airlines, Inc. showed a 47% gain in revenue passenger-miles in June over the same month in 1954, the largest increase of any period in the nonsked's history, the company reported. Revenue passenger-miles totaled 40,847,682 compared with 27,041,887 in June of last year.

"The increase was due to the addition of new DC-6B equipment to North American's fleet and the public acceptance of the airline's low-cost air-coach service," company official James Fishgrund stated.

another filter problem solved . . .
RADIO NOISE FILTER
TYPE LA-224F
2 AMP. 100 V.D.C.
INT. DUTY 125°C
SPRAGUE ELECTRIC CO.
MOTOR
LINE
R-F NOISE
ELIMINATED
IN BENDIX VALVE ACTUATOR
PROBLEM: Bendix Aviation Corporation's Pacific Division, North Hollywood, California, manufactures a series of rotary electric actuators for operating valves in aircraft. But getting a small, lightweight filter to keep the motor from creating radio-frequency interference proved to be a real problem. Any such filter would have to be mounted as an integral part of the square motor actuator, and the required 150°C operating temperature didn't help any.
APPROACH: Bendix Pacific engineers took their problem to the Radio Noise Suppression Laboratories of the Sprague Electric Company in Los Angeles. There, Sprague and Bendix engineers cooperated in making radio interference measurements and setting up envelope and mounting provisions for the proposed filter.
SOLUTION: A filter was designed by Sprague to meet the envelope, mounting and 150°C performance needs. The filter successfully passed radio interference requirements of MIL-I-6181, MIL-1-6181B, and also, the rigid requirements of MIL-E-5272A. When mounted, the Sprague filter is completely encased in the motor, with the filter terminals utilized as the motor terminal strip.
PRODUCTION SCHEDULES for these and many other filters are regularly met by Sprague plants on both coasts. We would like the opportunity to solve your problem too. Write, wire, or phone Sprague Electric Company, 12870 Panama Street, P.O. Box 66507, Los Angeles 66, California (TExas 0-7531) or North Adams, Massachusetts (MOhawk 3-5311).
Sprague on request will provide you with complete application engineering service for optimum results in the use of radio noise filters.
YOU CAN DEPEND ON
SPRAGUE
World's Largest Capacitor Manufacturer

Another casting problem solved...



ROLLE TAKES THE "HEAT" OFF PERMANENT MOLD CASTING INSERTS

PROBLEM: The John R. Hollingsworth Corp., Clifton Heights, Pa. had to secure permanent magnets in the rotors of their 12.5KW, 1714 RPM Alternators. Non-machinability of the magnets required their being cast as inserts in aluminum. *But, magnetic properties of magnets are such that the lowest possible temperature has to be maintained during the casting process.*

SOLUTION: Hollingsworth engineers brought the problem to Rolle's permanent mold casting division. Together with Rolle casting experts, they reached a workable solution.

RESULTS: In addition to providing a strong, compact mechanical assembly able to withstand high rotational speeds, Rolle's methods improved efficiency of the rotor. Magnetic output has been increased 10% over previous attempts by applying Rolle's advanced techniques, which assure a sound permanent mold casting yet keep insert temperature at an absolute minimum.

YOUR PROBLEM . . . whether it involves sand or permanent mold casting of aluminum or magnesium alloys . . . can always be solved quickly and economically if you bring it to Rolle. Write for free booklet that tells how you can

FIGHT WEIGHT WITH STRENGTH

PERTINENT DATA

Permanent mold cast alternator rotor with permanent magnet insert.

Alloy Aluminum 356
Temper As cast
Size 13" O.D. x 9⅞"
Weight 105 pounds

WITH **ROLLE**
MANUFACTURING COMPANY
301 Cannon Ave., Lansdale, Penna.

AMC Engine, Copter Orders: $93 Million

Engine contracts totaling $68 million have been awarded by Air Material Command, Wright-Patterson AFB. AMC also has placed $25 million in helicopter orders. The list of recent contract awards:

Chicago Aerial Industries, Inc., Melrose Park, Ill., test equipment, $101,528; converter, image velocity signal, 127 ea., detector, image velocity, 127 ea., $143,412.

Continental Motors Corp., Muskegon, Mich., engines 0-470-11, 159 ea., maintenance and engineering data, $524,079; engines for refuelers, 706 ea., engines for generator sets, 276 ea., $3,534,684.

Kollsman Instrument Corp., division of Standard Coil Products Corp., Elmhurst, N. Y., indicators, airspeed and Mach number, $105,564; computers, airspeed and Mach number, 142 ea., $251,268.

Wright Aeronautical Division, Curtiss-Wright Corp., Woodridge, N. J., engines, turbojet J65-W-5, $8,359,956; turbojet engines, J65-W-6, and related equipment, $32,541,952.

Motorola, Inc., Chicago, indicator, spare parts and data, $3,308,455.

Librascope, Inc., Glendale, Calif., computer set, navigational, spare parts, data and engineering services, $142,628.

Radioplane Co., subsidiary of Northrop Aircraft, Inc., Van Nuys, Calif., spare components of the C-2 remote flight control system, $1,272,148.

Edo Corp., College Point, N. Y., float assemblies, 42 ea., $148,357.

Westinghouse Electric Corp., Dayton, Ohio, indicator, pitch trim, 97 ea.; coupler, compass, 46 ea.; controller, flight, 33 ea.; control, angular rate, 17 ea.; actuator, hydraulic rudder, 59 ea.; valve, control, hydraulic, 14 ea., $186,440.

Northrop Aircraft, Inc., Hawthorne, Calif., F-89H mobile training units, 2 ea.; E-6 fire control system trainers, 3 ea., and technical data, $1,039,733.

Fairchild Aircraft Division, Fairchild Engine & Airplane Corp., Hagerstown, Md., modification of C-123B-1 mobile training unit components, heater system trainer for C-123B mobile training unit, $277,615.

Radio Corporation of America, Engineering Products Division, Camden, N. J., adapters, headset microphone, spare parts and data, $207,348; components of AN/APN-70, $430,365.

Rheem Mfg. Co., Philadelphia, trainer, fixed aerial gunnery, 8 ea., test and ground handling equipment, maintenance spare parts, $3,912,927.

Kearfott Co., Inc., Little Falls, N. J., indicator, master component of compass system, 351 ea., $700,656.

Ford Motor Co., Dearborn, Mich., turbojet engine, J57-F-13, 135 ea., turbojet engine J57-F-13 less afterburner assembly, 3 ea., $25,702,445.

Lear, Inc., Grand Rapids, Mich., automatic pilot systems, spare parts, data, $2,042,518.

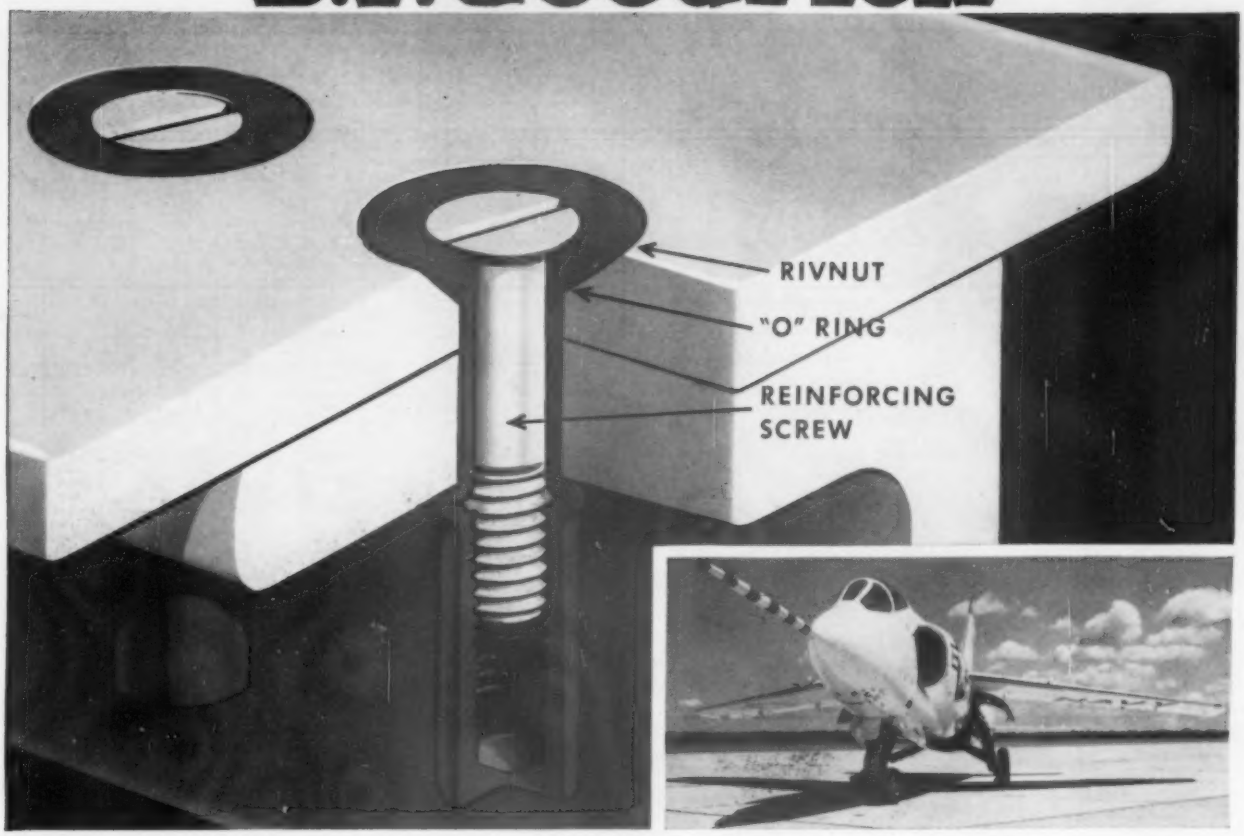
Hotpoint Co., division of General Electric Co., Chicago, turbosuperchargers, setting 5, 105 ea., turbosuperchargers, setting 6, 105 ea., $495,600.

Stromberg-Carlson Co., Rochester, N. Y., components of AN/APN-69, spare parts and data, $2,513,259.

Sikorsky Aircraft Division, United Aircraft Corp., Bridgeport, Conn., helicopters, H-34A, 43 ea.; spare parts for overhaul, 1 lot; spare parts for field and organization support, 1 lot; special tools and ground handling equipment, 1 lot; technical data, 1 lot, $16,$65,616; H-37 mobile training units, 1 set, $428,988.

Continental Aviation & Engineering Corp., Detroit, engines, J69-T-9, 40 ea., special tools, maintenance data, $1,127,288; production tooling, $474,118; engines, J69-T-19, 8 ea., engineering and maintenance data, $179,417.

RESEARCH KEEPS **B.F.Goodrich** FIRST IN RUBBER



Special new aviation Rivnut gives Tiger a longer leap

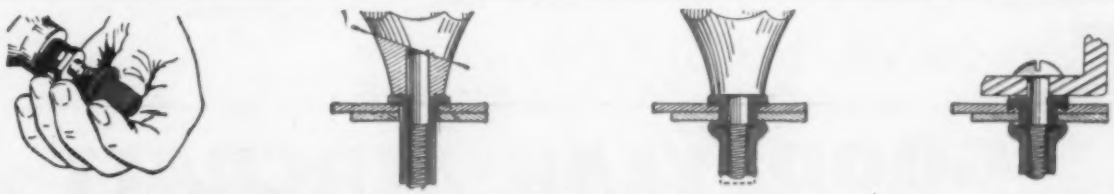
GRUMMAN engineers decided to use integral wing tanks to stretch the range of their F11F-1 Tiger. They would let the single top and bottom aluminum skin panels that form each wing also serve as fuel tank walls. The problem was to find a blind fastener that could join the wing sections tightly enough to stand the strains of supersonic flight and still prevent loss of fuel.

Working with Grumman, B. F. Goodrich engineers solved the problem by developing a new Seal-Head Rivnut with rubber "O" ring. The cross-section above shows how it works.

The B. F. Goodrich Seal-Head Rivnut is installed in a hole that's been drilled and countersunk in the wing skin panel. The Rivnut holds the sections together. The "O" ring makes a fuel-tight seal and withstands temperatures from –65° F. to 225° F. Then a special 150,000 p.s.i. tensile strength screw is screwed into the Rivnut to reinforce it. This fastener has been approved for primary aircraft structure.

Whatever your fastening problem, there's probably a B. F. Goodrich Rivnut that can solve it. For more information, write: *The B.F.Goodrich Company, Aeronautical Sales, Akron, Ohio.*

HOW STANDARD B. F. GOODRICH RIVNUT WORKS:

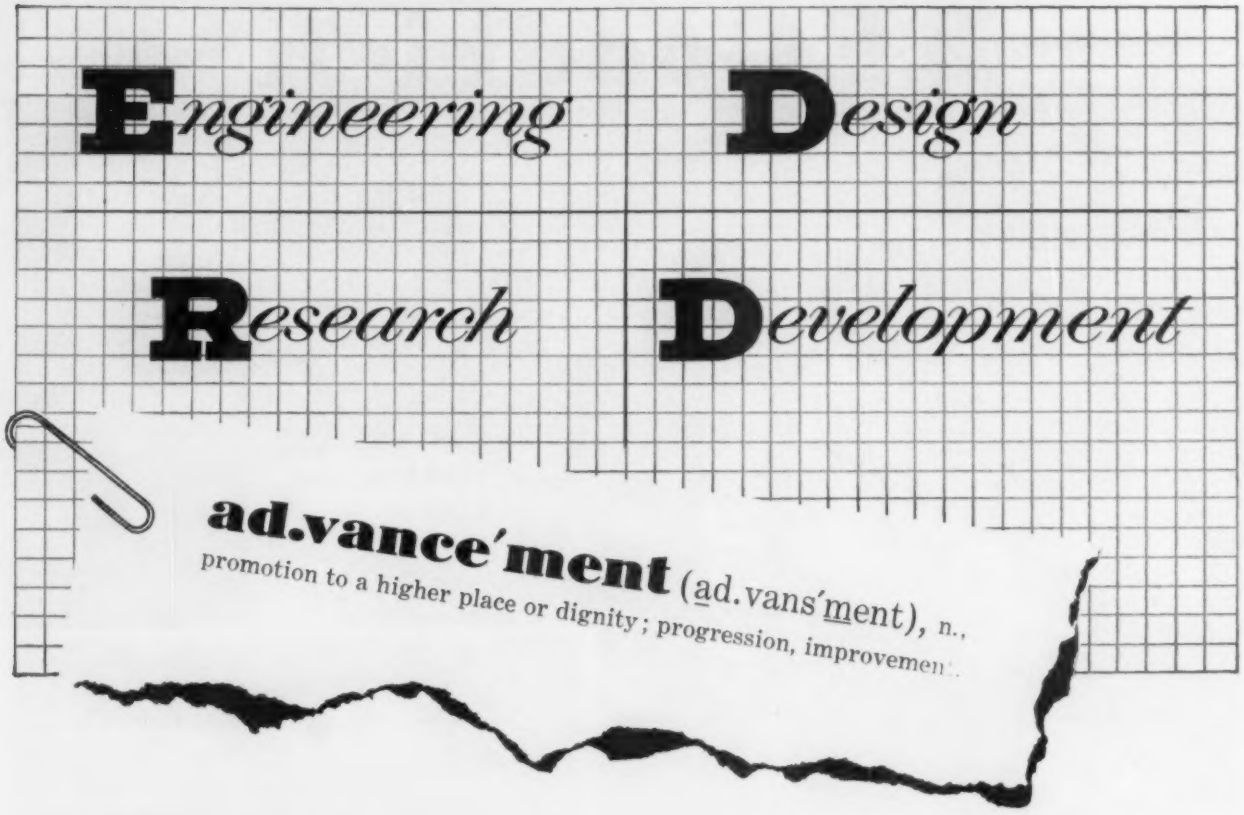


1. Standard Rivnut is threaded onto pull-up stud of a manual or pneumatic heading tool.

2. Rivnut is inserted, head firmly against work, tool at right angle to work.

3. Tool lever operates pull-up stud, forming a bulge in the Rivnut shank.

4. After upset, at least six Rivnut threads are clean, intact, ready for screw attachment.



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Jets Assist C-46

Twin 350-lb.-thrust Turbomeca Palas jet engines are lifting passenger C-46s off short runways on Varig Airlines' local service routes in Brazil.

Varig President Rubem M. Berta said the small French turbojets, mounted in pods under each wing, give the transports a rate of climb of 10 feet a second or 600 feet per minute.

"The passengers like it," said Berta. "They've been educated to know that it improves takeoff safety."

LAA-TWA Connect With New $2 Fare

Los Angeles—Los Angeles Airways has inaugurated a new fare for Southern California travelers connecting with Trans World Airlines' flights.

Under the new arrangement, $2 will be added to the regular airline fare for helicopter flights between Southern California points and Los Angeles International Airport.

Negotiations are underway with United, American and other carriers for similar fare structures.

Regular LAA fare structure scales from $3.85 one way to $8 for service to and from community heliports to L. A. International. The greater portion of difference between these fares and the $2 ticket will be absorbed by the major airlines.

Helicopter service includes direct-at-the gate connections to the passenger's outgoing airplane. Tickets are issued at the passenger's city of departure.

LAA President Clarence M. Belinn says that by the end of the year helicopter service will be extended to Corona, Fontana, North Hollywood, Ontario, Pomona, Riverside and Santa Monica.

CAA Okays Madsen Lights for DC-3s

Los Angeles—Civil Aeronautics Administration has approved installation of Madsen lights on DC-3 aircraft, designed to lessen chances of mid-air collision by indicating direction of plane's movement, its position and altitude.

At the same time, Transocean Air Lines has launched limited production of the airborne safety aid, and the Garrett Corp.'s AiResearch Aviation Service Division has announced it is prepared to make the installation on any DC-3.

Madsen lights consist of seven high-intensity flashtubes mounted on the top and bottom of the aft fuselage, flashing in a rapid aft-to-forward sequence (AW June 14, 1954, p. 80). They were designed by Capt. Andrew Madsen, a Transocean Air Lines pilot, and have been in use on Transocean DC-4s for some time. United Air Lines is testing the system on a DC-6.

AiResearch reports that in a recent night test the lights could be seen, and readily identified over Long Beach, by an observer on the ground at Santa Monica Airport, 35 miles away. In another instance the illumination has been observed in light rain at a distance of 17 miles, the company says.

Reports also indicate that the lights are so strong that in broad daylight they are easily visible for several thousand feet. They flash for 1/1000 of a second at ½-second intervals, giving the appearance of white lines moving across the sky in the same direction as the plane.

The Madsen lights DC-3 installation, including transformer rectifier, condenser, and wiring and fixtures, weighs approximately 10 lb.

Initial production of the Madsen system will be handled by Transocean's subsidiary Aircraft Engineering & Maintenance Co., Oakland, Calif., says Orvis Nelson, Taloa's president. He also reveals that research and development is being done on a model for supersonic aircraft.

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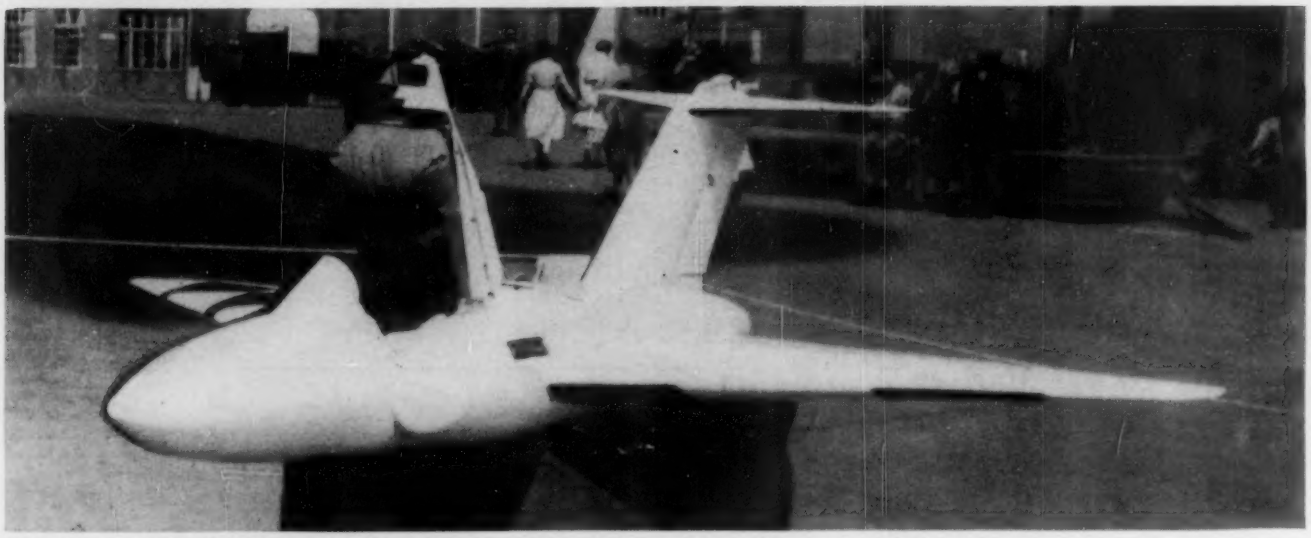


SPIN-TEST MODEL of Goster Javelin delta all-weather fighter is dropped from balloon. Open hatch shows recovery parachute.

Farnborough Demonstrates Latest Steps in

London – Flight demonstrations of English Electric's P-1, Britain's long-range supersonic interceptor prototype, highlighted the Golden Jubilee exhibition of the Royal Aircraft Establishment at Farnborough.

A combination of static and flying displays gave a small segment of the British public its biggest look into the inner workings of its top research center.

In the various research, testing and administrative buildings were a wide variety of displays covering every aspect of aviation development. Wind tunnels, computers, fatigue and structural test rigs, machine shops, hangars were all open to public inspection. In a large hangar each RAE Department as well as the various air and ancillary services had additional exhibitions as well.

These specific items gave an insight into the technological progress and direction of aviation in Britain:

• **Wing tip rocket pods,** some with wire rifling holding seven five-inch missiles, others carrying up to 31 smaller projectiles.

• **A barrage balloon** rigged with a scale model Javelin used in free-fall flight tests.

• **A new "ooze" theory on fatigue.**

• **A dozen trans- and supersonic free-flight models** plus their booster rockets.

• **Guided missile test vehicles,** including cutaway sections, exploded view of components.

• **Titanium alloys** with a maximum tensile strength of 97 tons per square inch.

• **Hydrodynamic seals** used in rocket motor fuel pumps.

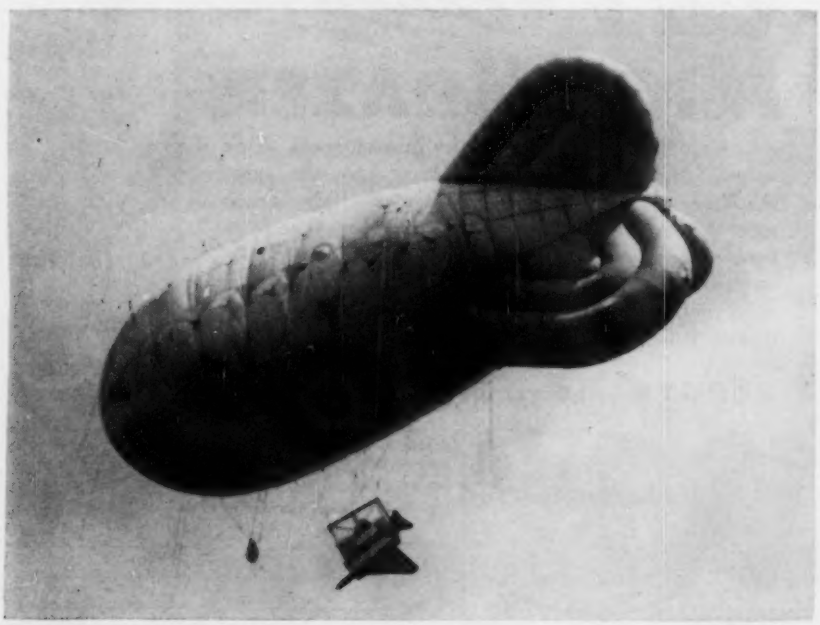
• **Three full-scale water tanks** for pressurization fatigue testing, including one with the wings of a Britannia protruding (AW July 18, p. 35).

• **Hunter Aden gun package** rigged with vibration test and recording gear.

• **Static aircraft exhibit** showing planes dating from 1912 and ranging on up through World War I and World War II to postwar research aircraft and present-day models.

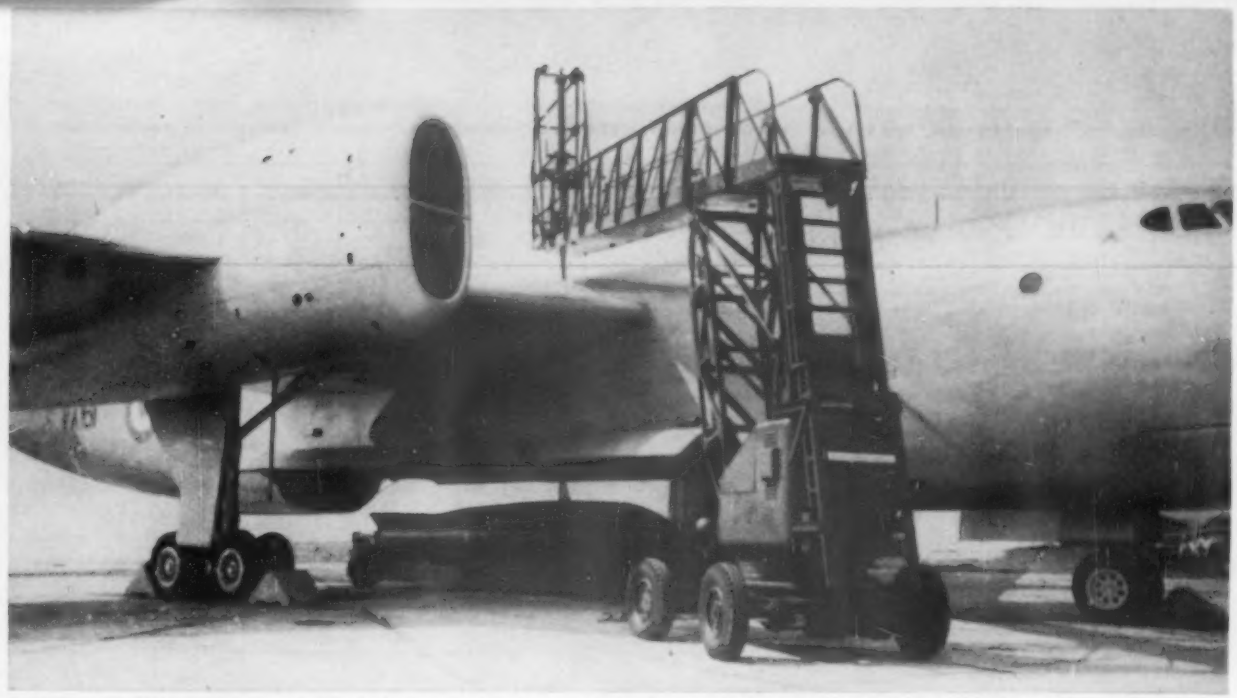
• **Comic, "prehistoric" bomber** manned by five lion-skinned clad crewmen and powered by two pterodactyls.

• **A display of precision formation aerobatics** involving two teams of four Hunters and four Meteors, a high and a low speed fly-pass by Britain's only straight and level supersonic prototype, the English Electric P-1 and finally, to top the day off and end with aviation's beginning, a manned flight in a free balloon.



LARGE-SCALE JAVELIN MODEL used in spin tests hangs beneath captive balloon.

The P-1 prototype made several high and low speed passes over the field,



GANTRY CRANE works through hatch in top of Short Sperrin fuselage to load 10,000-lb. bomb into high-altitude testbed's bay.

Air Research

showing exceptional maneuverability at high speed. The wings, with tip controls, were shaped very much like those of the Short SB-5 research plane and seemed to have the extreme sweepback (69 degrees) of that aerodynamic predecessor of the P-1.

Gloster's controversial Javelin all-weather fighter demonstrated its aerobatic abilities and highspeed maneuverability.

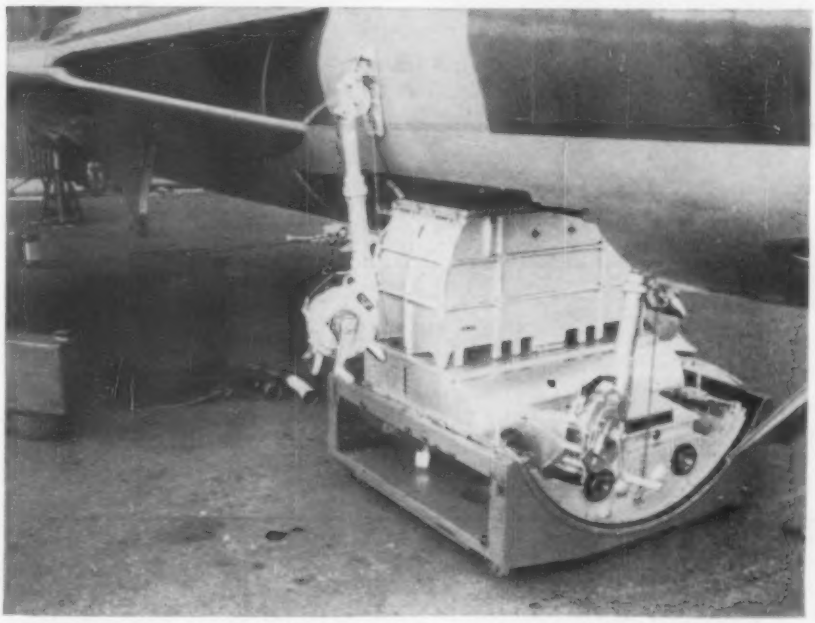
Static Exhibits

Highlights of the static show, in many cases hidden by prosaic headings, included:

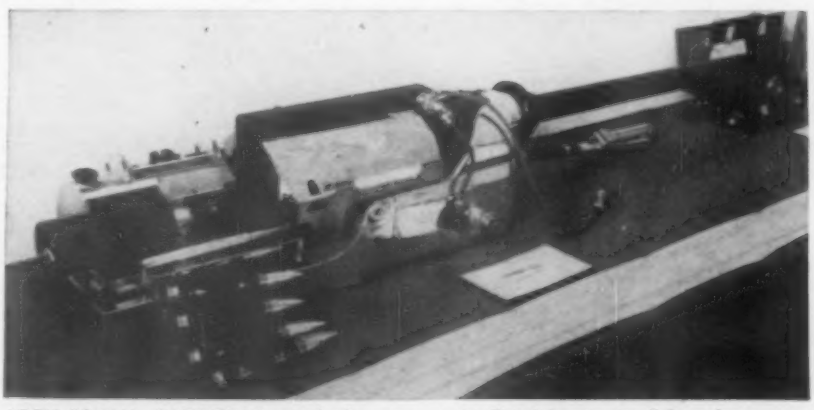
• **Raindrop erosion.** A single raindrop, supported on a spider web, was fired at by a Mach One bullet. Frightening deformation of slug graphically indicated problem of rain impact on supersonic all-weather fighters.

• **High-altitude flight.** An experimental full-pressure suit for prolonged operation above 40,000 ft. without cabin pressure was shown for the first time. Pressure cabin failure or puncture could result in loss of aircraft through insufficient fuel if a descent to below 40,000 ft. became necessary on a long mission. New silver flexible suit has a semi-circular bowl-type visor, and was shown alongside developments of USAF partial pressure suit, with automatic visors.

Also shown was an individual pressure capsule, built during the War for Prime Minister Churchill's York and B-24 flights, complete with internal telephone system, to provide equivalent



GUN PACK with ammunition cans is ready to be winched into Hawker Hunter belly.



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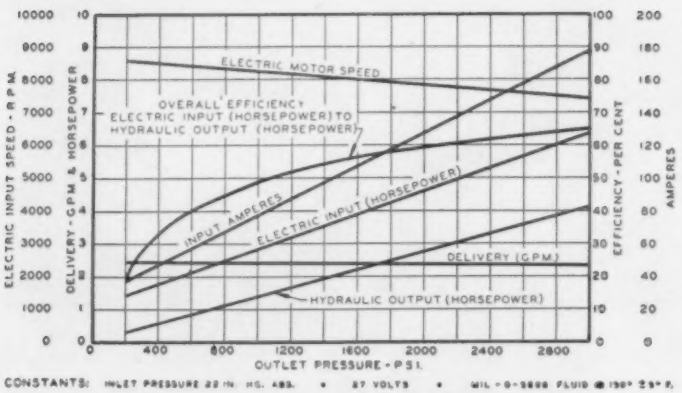
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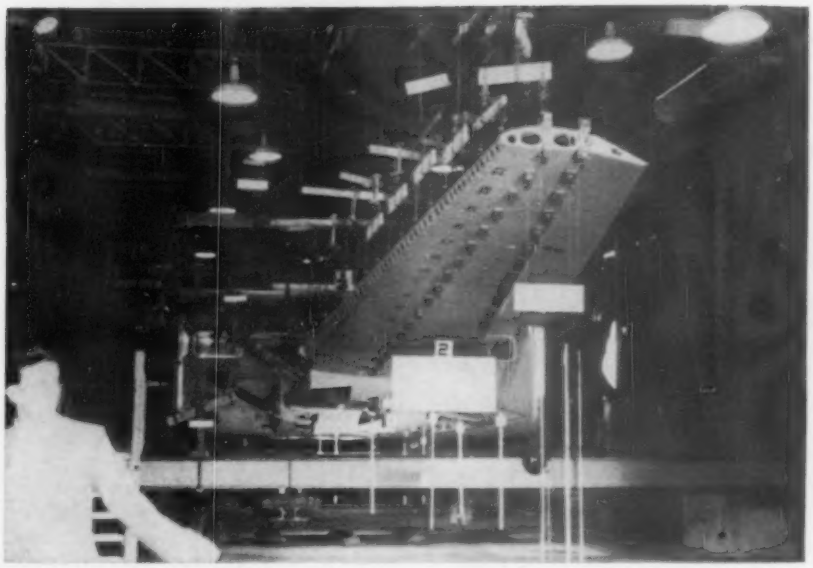


DH HERON WING specimen undergoes static test in Farnborough's "cathedral" rig.

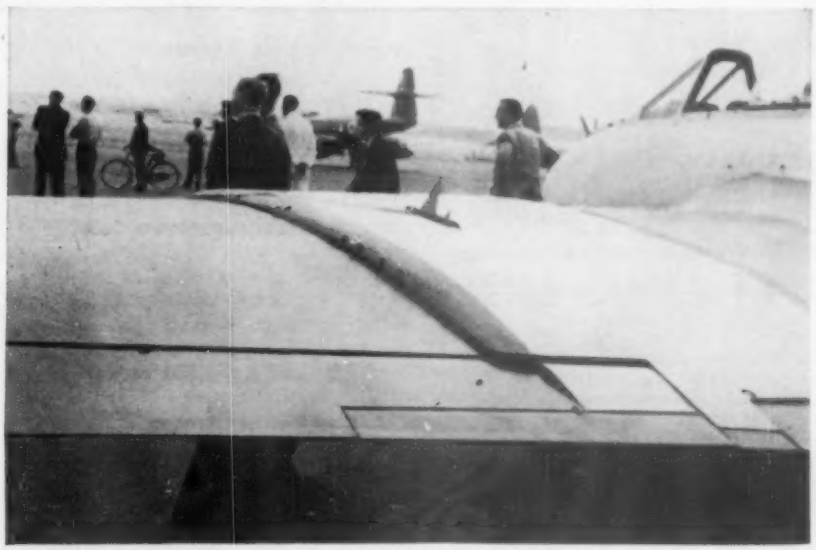
of less than 8,000 ft., up to 25,000 ft. It was never used in practice.

• **All-altitude ejections.** Slow motion films were shown of successful dummy ejections with Martin-Baker automatic seats at altitudes between 40,000 and 50 ft., from English Electric Canberras. An actual seat was also shown, with stabilizing drogue and pilot's parachute. The 50 ft. seat is not yet installed in production aircraft.

• **Parachute development.** Various types of load up to 4,000 lb. in weight were shown dropping from Fairchild C-119 which has been on loan for several years to the Ministry of Supply for such experiments. Many types of chute were employed, including a single 66 ft. diameter split-gore type for the heaviest load. Metal pallet or platform used for loading guns or vehicles for dropping was also shown static.

Unusual application of brake parachute on experimental Avro 707B, low-speed research delta, was small canopy on right wing tip for applying known yawing moment. This machine also had 1,000 lb. sand-filled bomb under the same wing, plus lead in the leading edge, for known rolling moment. The other wing was extensively wool tufted, with a smoke canister and tube to make airflow visible.

• **Guided missile development.** No operational weapons were displayed, but a large number of RTVs (Rocket Test Vehicles); CTVs (Component Test Vehicles); ATVs (Aerodynamic Test Vehicle) and GPVs (General Purpose Vehicle) were on view, together with guidance components and systems. One large missile, the RTV-2 was shown after having been recovered from the sea, following test firing, with its trail



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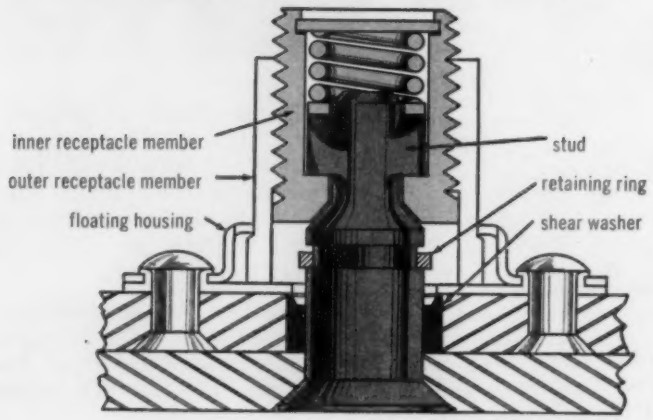

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of brake and recovery parachutes.

Many film sequences were shown, including several from the missile itself, during launching. Most graphic showed flutter of double-wedge control surface, which eventually broke off, resulting in crazy gyrations of visible horizon.

• **Armament.** The electrically percussed 30-mm. Aden cannon, standard weapon on current British fighters, was displayed. A compact, short-barreled cannon, the Aden has a cyclic rate of fire of about 1,000 rpm., and a muzzle velocity somewhat under 2,000 fps. Most current fighters carry eight to ten seconds worth of ammunition. Gun barrels are good for over 5,000 rounds. A demonstration of Hunter rearming, using a removable gun pack, was a feature of the static park display.

Also shown were first British rocket pods, not yet air-tested. One, labeled "rocket launcher, slow, spun," and weighing 134 lb., had seven barrels, with internal spiral rails.

More operational in appearance was the 60 mm. rocket battery, for a wing-tip installation, with stabilizing fins, and containing 31 missiles. These new British AAMs were also exhibited with either spin- or folding-fin stabilization. A smaller battery contained seven 60 mm. rockets. For ground attack, the new Mk. 12 underwing rocket launcher was shown, with close-stacked 3 in. No. 1 Mk. 5 projectiles, for "future aircraft".

• **Bombs.** Close attention is obviously still being paid to conventional bombs, despite atomic complex. New series of jet-stowed bombs, with flip-out fins, ranged from 500 to 5,000 lb. In the static park, loading of a 10,000 lb. missile on prototype Short Sperrin was thought to be a guide to V-bomber technique. Loading involves gantry over fuselage, with hoist going through hatch in upper skin, and lifting bomb from trolley under the bomb bay.

Aerodynamics Research

Another major section of the display was devoted to aerodynamic research. Of particular interest was a free-flight testing system from a large kite balloon, of large-scale models as an extension of research in a vertical wind tunnel. The example shown suspended beneath the tethered balloon was a dynamically similar model of the Gloster Javelin delta. After ascending to about 3,500 ft. beneath the balloon, the model is rotated in the direction of the desired spin, and then released with its controls set at full rudder, full up elevator and neutral aileron.

After four turns of the spin, a program motor applies corrective control—full opposite rudder and aileron, then full down elevator—and holds it for five seconds. Recovery follows in less than 1 second, and the controls

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are then centralized. After pulling out from the ensuing dive, the Javelin model is retrieved by parachute. The significance of these tests is that they have been confirmed by full-scale flight trials, so that whatever other troubles the Javelin may have had, spinning was not one of them.

The high-speed testing of models by free flight rockets follows a similar pattern to that of NACA, from the examples shown. Another well tried technique is the installation of model configurations on an aerodynamic "glove", mounted on the wing of a jet fighter. At Farnborough, this was on a Vampire 3, and the oscillatory characteristics of a double delta layout could be studied at supersonic speed when the aircraft itself was flying well within its Mach limitation of about .78.

Other flight research was illustrated by a wool-tufted and ballasted Short S.B. 5, with ground-adjustable drooping leading-edge and low-set tailplane, a flying scale model of the English Electric P.1 supersonic fighter.

'Bedstead' Stabilizer

Attracting most attention was Rolls-Royce's bizarre "bedstead", which unfortunately did not fly in the program, although it has done a fair amount since being at Farnborough. Remarkably simple in basic form, the Bedstead's key is in the automatic stabilisation, housed in a series of little boxes behind the pilot's seat, which makes it relatively simple to fly.

Since its first appearance, it has grown a new crash pylon over the "cockpit", plus one or two external features. With about 7-8,000 lb. of thrust, the Bedstead has a maximum speed unofficially estimated at 60 mph, but although it now bears a military serial number, it still has no pretensions to being called an airplane. Rolls-Royce seem determined not to enter the airframe business, and as far as they are concerned, it remains a thrust measuring rig.

Another move towards VTOL was indicated by the Westland-modified Nene-powered jet deflection Meteor, another newcomer to a public display. The bulk of this machine's nacelles are merely the result of mounting the engines forward of the main spar, to allow the downward pointing jet pipes clearance, and the jet deflecting mechanism is simply like a large throttle butterfly, aft of the turbine.

In the flying display, the deflector Meteor approached normally to land, but in the final stages, the throttles were opened up after deflection, and the speed was noticeably reduced as well as the descent being checked. The landing roll was about half that of a normal Meteor.

This machine flew alongside the prone-pilot Meteor, which is still doing as much flying as it has done in the past, if the worn neck-rest in the prone cockpit is any guide. It landed, quite normally, under control from the prone occupant, but it was not possible to see the control system in use.

Fatigue Theory

RAE researchers have come up with a new theory on fatigue. Alloyed metals under continual, "high" cyclic stress tend to force out (ooze) some of their constituent materials leaving a crack.

Farnborough's work on the mechanism of fatigue is primarily with the high-strength light alloys. In more technical detail, these are the materials which form limited solid solutions in the fused state. They are amenable to precipitation hardening; certain alloying constituents are precipitated under heat treatment, thus strengthening the grain boundaries. Excessive heat treatment causes the metal to soften. RAE says that vibrational forces which give rise to cyclic loading can produce the same effect as excessive heat treatment. Recrystalization and excessive precipitation take place and the metal fatigues. Molecularly small regions become soft

due to depletion of their solute elements. Under further cyclic loading this soft material is then extruded from the surface in thin ribbons. Where the metal oozes out it leaves a crack.

Accelerating progression of the fault proceeds; the metal becomes soft and gets weaker. Because it gets weaker, the surrounding metal experiences higher stresses and consequently speeds the precipitation. At the same time, the geometry of the crack itself induces higher stress concentrations at its root which also aggravates the condition.

There were microphotographs on display showing these ribbons being extruded from the crystal lattice of an actual light alloy specimen that had undergone a large number of stress reversals.

Apart from the considerations of solid solutions and precipitation, it is believed that here the softening and heating process due to the distortion of the crystal lattice under stress reversals is characteristic of all metal crystallographic structures. It's an inherent weakness in the structure of matter. Regardless of how you fuse it, mix it and fabricate it, the most you can do is to delay the eventful failure of the metal under fatigue loading. Also, at higher temperatures, the atomic mobility of the material increases and further hastens the deterioration process.

Intensive work on fundamental and engineering problems of fatigue form a major part of the research program at Farnborough. Much of this is currently concerned with titanium alloys. In most cases the specimen is in strip form with a hole of about ⅛" diameter in the waist, simulating the stress concentration effects of rivet holes. Stresses up to three times the normal are experienced at the periphery of the hole.

A lot of work is also being carried out on notched specimens turned from bar stock. The "notch" is a surface scratch 0.008" long with a root radius of 0.004" having a stress raising factor of three at the root.

Batteries of conventional Haigh direct stress electro-magnetic fatigue testing machines were shown during the exhibition. These work up to 6000 cycles/sec. some being equipped with split furnaces for high temperature fatigue loading.

A film showing the development and propagation of a fatigue crack was shown to visitors. Farnborough is also proud of the fact that the first piece of titanium metal in Britain was prepared in its metallurgy department.

Corrosion Studies

Corrosion, particularly with regard to its influence on crack propagation and fatigue, is another aspect of current high-priority research. In vacuum and in protective atmospheres, test pieces have exhibited more prolonged lives. The array of equipment for metallurgical research at Farnborough includes the use of radio-active tracers, X-ray machines, X-ray diffraction cameras, and electron microscopes.

The attainment of very high temperatures by high frequency induction heating was illustrated in the course of hot-pressing zirconium carbide. The high strength and ductility of molybdenum at elevated temperatures—it is superior to all metals and ceramets—is nullified by its catastrophic oxidation rate. Considerable success has been achieved very recently by different groups of workers on coating molybdenum with an oxidized coating usually a cermet. Farnborough was showing some coated heating elements in molybdenum maintained at 2,160F.

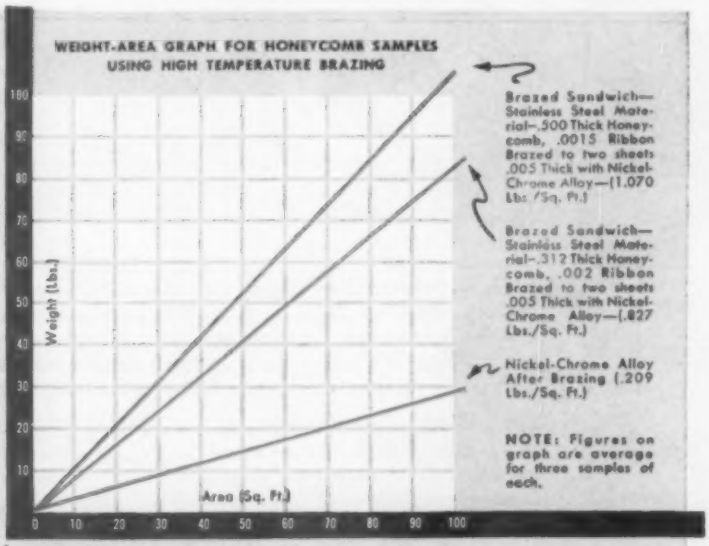
The metallurgical department at Farnborough thinks it has the jump in developing a new group of titanium alloys. These are destined for the skin and structure components in supersonic aircraft which get hot.

They were showing two alloys of which they are specially proud. One is a titanium vanadium alloy and the other titanium-molybdenum, the percentage of the alloying element being up to 16%. These metals show par-

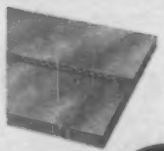
HIGH TEMPERATURE BRAZING INSURES STRENGTH AT HIGH TEMPERATURES . . . Brazing of skin sheets to core material with a nickel-chrome alloy is accomplished in a completely controlled atmosphere (no flux) at approximately 1950°. All parts thoroughly bright annealed when finished.

*When construction consists of .005 thick cover sheets and .0015 thick honeycomb foil.

LIGHTWEIGHT STRUCTURES SOLVE DEAD WEIGHT PROBLEM . . . Honeycomb sections offer amazing strength-to-weight ratio. Graph at right shows average weight per square foot of sample panels. Intricate shapes fabricated by Twigg include compound curved panels, cylinders, tapered thickness panels, etc.


WEIGHT-AREA GRAPH FOR HONEYCOMB SAMPLES USING HIGH TEMPERATURE BRAZING
Weight (Lbs.)
Area (Sq. Ft.)
0 10 20 30 40 50 60 70 80 90 100
10 20 30 40 50 60 70 80 90 100
Brazed Sandwich—Stainless Steel Material—.500 Thick Honeycomb, .0015 Ribbon Brazed to two sheets .005 Thick with Nickel-Chrome Alloy—(1.070 Lbs./Sq. Ft.)
Brazed Sandwich—Stainless Steel Material—.312 Thick Honeycomb, .002 Ribbon Brazed to two sheets .005 Thick with Nickel-Chrome Alloy—(.827 Lbs./Sq. Ft.)
Nickel-Chrome Alloy After Brazing (.209 Lbs./Sq. Ft.)
NOTE: Figures on graph are average for three samples of each.

HONEYCOMB FABRICATION OFFERS UNLIMITED POSSIBILITIES . . . Precision aircraft and guided missile parts requiring lightness, strength, heat and corrosion resistance are particularly suitable to honeycomb fabrication. Applications may include compressor casings, burner supports, turbine frames, bulkheads, flooring, shrouding, insulating blankets, pressure ducting and wing sections.



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Designing and fabricating stainless steel honeycomb structures into strong, lightweight assemblies is typical of Twigg's highly advanced metal-working techniques. Write today for your copy of our brochure, "TWIGG CAN DO IT," describing complete facilities for fabricating and machining high capacity metals.

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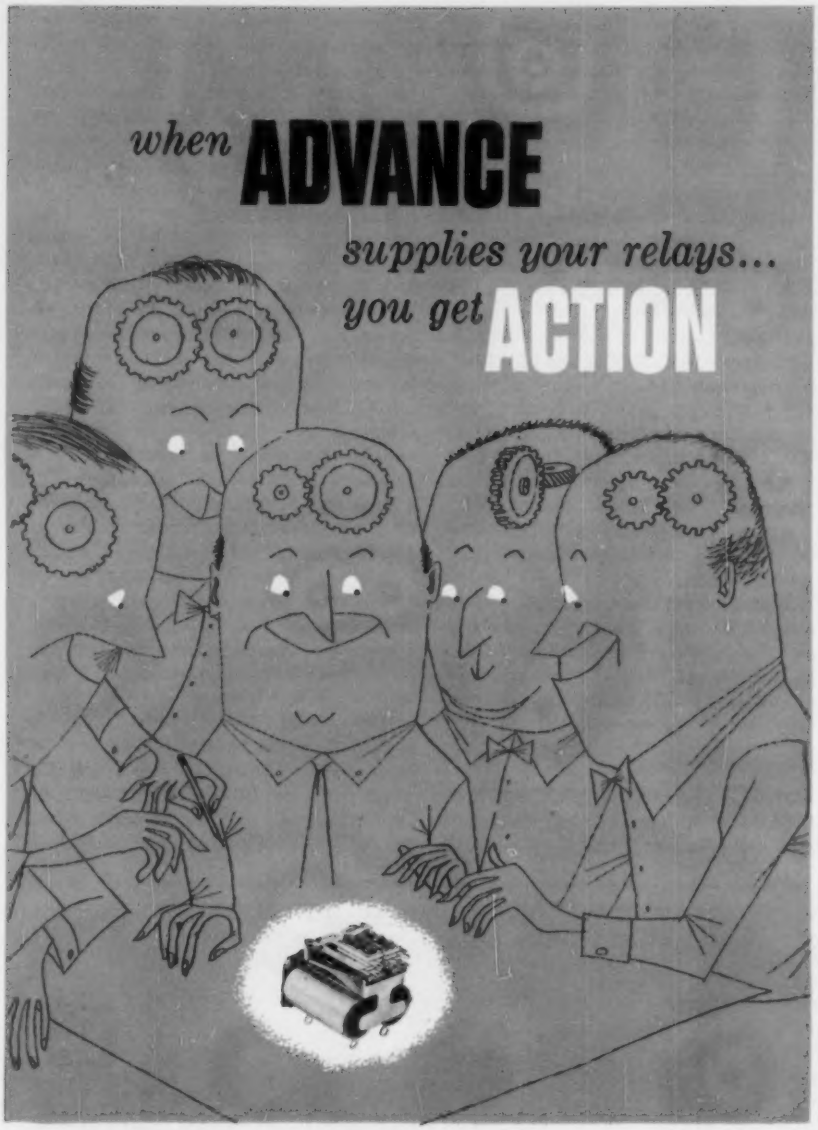

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ticularly high strength in the 720 F temperature region, expected as skin temperatures at the higher Mach numbers. The tensile strength of these alloys is as high as 97 tons/sq. in., twice that of the aluminum alloys. Their advantage over the alternative stainless steels is that they are somewhat stronger for only half the weight.

While the importance of the ceramic group of high temperature materials is fully realized in Britain, most of the research has been farmed out to industry and other national research establishments. Very little work was shown at Farnborough. Other important developments in the metallurgical field are new processes, to cut the cost of titanium sponge and powder. There are schematic diagrams of a vaporizing process using chlorides for the reduction of ferro-titanium which is the commonest and cheapest form in which the metal occurs. The other reduction process illustrated for titanium is electrolytic.

Heating Problems

One of the problems of kinematic heating at supersonic speed is the temperature gradient in the spar web structure of the wing. The difficulty in assessing the stress systems developed arises from the fact that until recently it was extremely difficult to simulate the nature of the thermal heating on a scale model, since the condition is a transient one and is consequently a function of time. The main requirement was for a heat source on the model which could be precisely lo-

XT53 for Bell XH-40

A 825-hp. free-power gas turbine designed and built by Lycoming Division of Avco Manufacturing Corp., will power the new lightweight Bell XH-40 utility copter being developed for the U. S. Army (AW July 18, p. 7).

First details of Lycoming's new XT53 reveal it is designed for "work-horse" applications in fixed-wing aircraft as well as rotary-wing types. The turbine features a front-end drive, although in special applications, rear-end or simultaneous front-and-rear power extraction can be made, Lycoming reports. Continuous power rating is 770 hp.

Development of the XT53 has been under direction of Dr. Anselm Fritz, Lycoming vice president-turbine engineering who was vice president-engine development for Junkers in Germany during World War II where he worked on the Jumo 004 turbojet. The XT53 is one of two turbine engines being developed for Air Force at the company's Stratford, Conn., plant.

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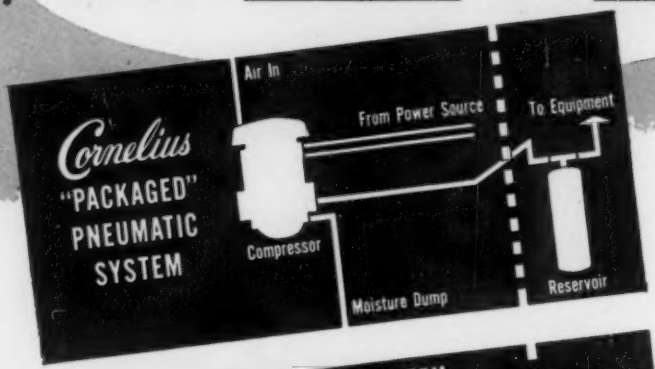
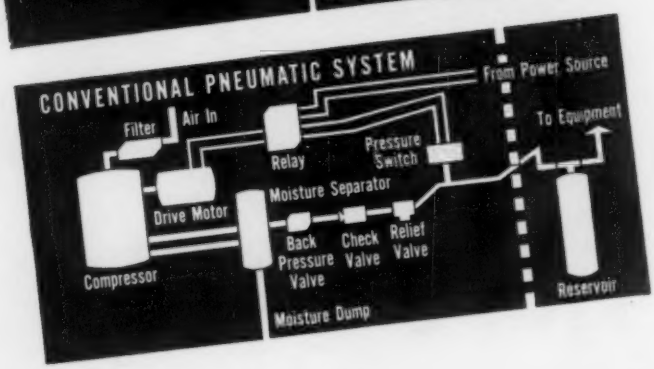
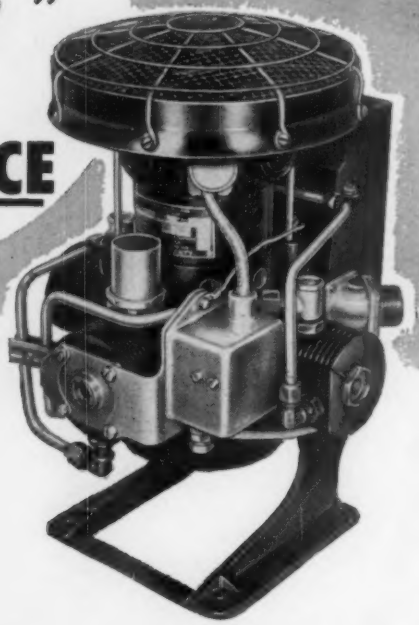
Cornelius

"PACKAGED" PNEUMATIC SYSTEM SAVES WEIGHT and SPACE







*The Cornelius Compressor, Model 130, 2CFM, 3000 PSI, is used in the McDonnell F2H-3 and F3H, North American FJ-2, FJ-3 and FJ-4, Chance Vought F7U-3, Grumman F9F-9. Also on order for the Lockheed P2V, Grumman S2F and Martin P5M. Thousands of service hours under all operational conditions is proof of outstanding performance.

The Cornelius Model 130 compressor* is the heart of the complete Cornelius "packaged" pneumatic system which includes inlet air filter, starting relay, radio noise filter, moisture separator with automatic condensate dump and heating element, back pressure valve, check valve, relief valve and pressure switch.

Compact Design Saves Space—Entire air supply system occupies only slightly more space than compressor alone in conventional system.

Weight Savings of 5 pounds or more are possible by eliminating separate system components, associated tubing, fittings and flare connections.

System Leakage Is Reduced to a minimum because integration of components removes possible leakage sources such as flare connections and o-ring sealed fittings.

System Reliability Is Assured because each integral component is designed specifically to give optimum performance in combination with the other components.

Time Saved by installation and servicing of *one* unit is another valuable benefit which only Cornelius "packaged" pneumatic systems offer.

The Cornelius "packaged" pneumatic systems are available with either DC, AC or hydraulic motor drives. Please write us in order that a Sales Engineer may discuss with you the application of this "packaged" system as well as the many other pneumatic components which we manufacture.

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PIONEERS IN THE DEVELOPMENT OF AIRCRAFT PNEUMATIC SYSTEMS

cated and measured.

This requirement was satisfied by the development of the Philips quartz tubular infra-red heating element. These tubes, only ⅜" in diameter by 14" long have an output of up to 3 kw. each. For measuring the actual radiation flux, Farnborough has developed a meter using a thermistor bead as the sensing element. The characteristics of this semi-conductor are such that its resistance drops from 2000 to 600 ohms when the current increases from 0 to 4 watts/cm². The response has a delay of less than 1 sec. An electronic computer completes the rig as developed at Farnborough. Into it are fed the theoretical aerodynamic conditions together with the heat input as measured by the pyrometer.

The computor adjusts the heat input to equal the transient aerodynamic heating data fed in at the other end of the computor. The thermal strains are then measured with conventional strain gages. A model of a structural testing frame with these heating elements disposed over the wing skin of a Mach 3 aircraft suggested the shape of things to come in rig testing.

The RAE's "cathedral" test rig, though one of the largest in Europe, is now too small on lateral dimensions to handle today's larger swept wings. A new structure has been designed which will not be so compromised by wing geometry. A model of this future unit showed a sweptback trapezoidal wing rig for both mechanical and thermal stress analysis.

A number of special techniques used in experimental biaxial stress analysis were also demonstrated. Apart from the more familiar photoelastic methods using plastic scale models, the brittle-coating technique developed at Farnborough was demonstrated. With this

Pilot Stutter

Stuttering may be easier to understand than normal speech while flying. Researchers on a USAF project at Ohio State University report that a radio message, transmitted when noise interference is high, comes through better if the speaker says "wuh-one, tuh-two" rather than "one, two."

This "bounce block" stutter, in which the first consonant is repeated, proved most effective in these tests recently conducted on persons from Japan, India, Jordan and Hungary as well as on Americans.

Further research will be done to determine the intelligibility of "double bounce block" stuttering in aircraft communication.

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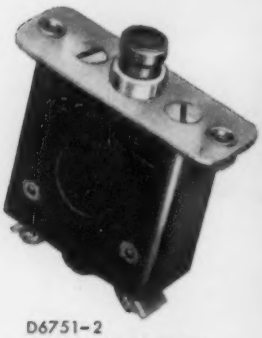

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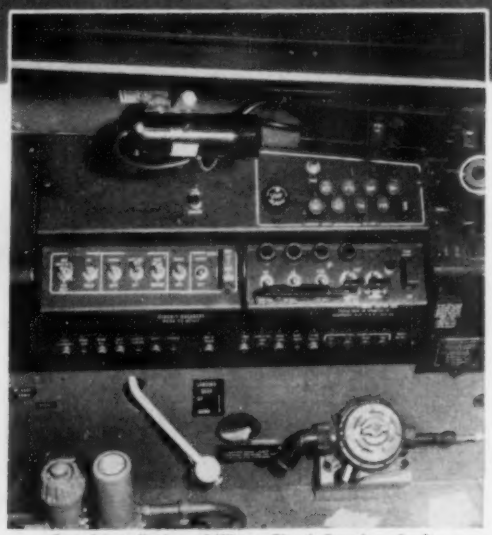

Panel installation of Klixon Circuit Breakers in the Lockheed T-33 Jet Trainer

Get Dependable Electrical Circuit Protection

with KLIXON Breakers

The Lockheed T-33 is the only U. S. two-place jet trainer supplied to the U. S. Air Forces, Navy, and Marine Corps, as well as the air forces of six foreign countries.

For top electric circuit performance, Lockheed uses Klixon Breakers in the T-33 trainer as well as other Lockheed Aircraft. The reason — Klixon Breakers are unexcelled for safe, reliable protection against shorts or dangerous overloads.

Like these precision-maneuvering planes, Klixon Circuit Breakers are designed and built to give outstanding performance under all flying conditions. They are precision calibrated and individually tested for ultimate trip and 200% load tripping characteristics. Write for data giving complete details.

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system the surface stress distribution on an actual component or structure can be visualised and determined. Some of the equipment for applying the brittle coating was displayed together with that for assessing the performance of the coating.

Another major problem concerning the structural department is that investigation of flutter and other vibrational problems arising either in the airframe or the propulsion mechanism in the air or on the ground. Equipment and techniques for exciting these disturbances were shown.

Critical Metal Limits Set for Turbojets

Jet engine manufacturers have been ordered to put a limit on the amount of rare metal they use for each 1,000 lb. of thrust produced by their engines.

The military services are told, in a new directive signed by Frank D. Newbury, Assistant Secretary of Defense for Applications Engineering, that they are responsible for reaching this objective:

"Except where performance would be prejudiced, each turbojet engine shall consume for its construction, on a gross weight basis, not more than 13 lb. of cobalt, 63 lb. of nickel, 110 lb. of chromium, .35 lb. of columbium, 5.5 lb. of molybdenum and 4.6 lb. of tungsten, for each 1,000 lb. of sea level static thrust delivered by the engine."

The instruction says the conservation effort should not result in reduced performance but still aim to prevent needless use of critical materials in new engines.

Starting as soon as possible in the history of a new engine, a count will be made of the amount of rare metals used for each 1,000 lb. of thrust and steps taken to see that it is made to conform with the policy.

The armed forces are ordered by Newbury to report by September 30 each year their requirements for each production and development engine model per 1,000 lb. of thrust, the gross-to-net ratio and the total thrust of each model.

Avien Sells Stock

Avien, Inc., Woodside, N. Y., aircraft instrument and control systems maker, has sold 99,800 shares of its Class A stock to the public at an offering price of $3 per share. The firm is expected to declare 7-½-cents-per-share quarterly dividend on these shares in the third quarter of this year. With the offering, Avien acquired all stock in Control Laboratories, Inc., N. Y., and Avien Service Corp., Culver City, Calif., formerly affiliates.

- Steering Collar Insulator
- Radiator Hose
- Heater Hose
- Body Insulators
- Heater Can Anti-Squeak Pad
- Steering Post Bracket Insulator
- Spark Plug Covers
- Steering Post Pads
- Radiator Drain Tube
- Silent Block Bushing
- Tail Pipe Insulator Support
- Wiper Hose
- Antenna Gaskets
- Division Channel Weatherstrip
- Window Channel Filler Seal
- Parking Light Lens Gaskets
- Bumper to Fender Spacer
- Fresh Air Adapter Grommets
- Battery Drain Tubes
- Gearshift Lever Arm Bushing
- Replacement Tubes
- Frame & Axle Bumpers
- Spring Shackle Bushings
- Fender & Engine Compartment Dust Shield
- Steering Wheel Spoke Ornament Cushion
- Instrument Panel Anti-Squeaks, Wiring Grommets
- Windshield Wiper Pivot Pad & Bracket Grommet
- Rear Window Weatherstrips
- Horn Ring Ornament Cushion
- Dash Liner & Cowl Trim Pads
- Door Check Arm Bumpers
- Stone Deflector Bumper
- Sound Deadener Insulation
- Tubeless Tires
- Wiring Clips
- Body Shims
- Headlight Lens Gaskets
- Radiator to Hood Seals
- Tail & Stop Lamp Lens Pads
- Radiator Seals
- Hood Lacing
- Fender Seals
- Hood Bumpers
- Bumper Grommet
- Glove Box Door Bumpers
- Gas Tank Filler Neck Grommet
- Sill Mats & Attaching Grommets
- Defroster Hose
- Door Bumpers

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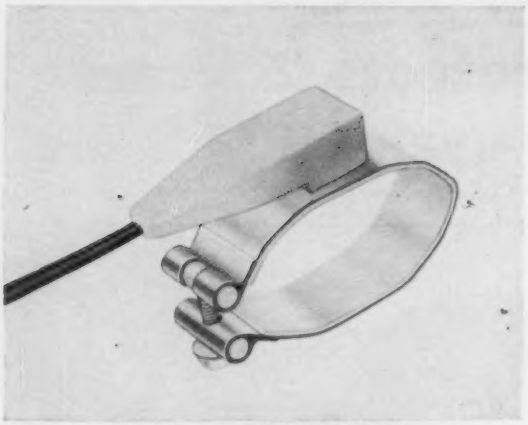
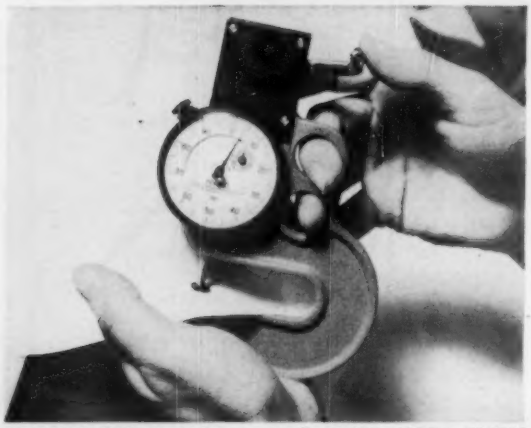


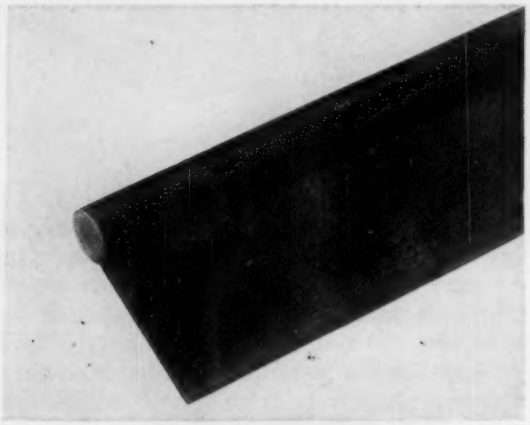
ACTUATOR CONTROLLER HEATER

Heat had to be provided to an *Actuator Controller* to maintain correct operating temperature. Limited space and weight factors complicated the problem which was solved by the small clamp-type heating element shown. Preformed and molded out of silicone rubber, the heating blanket is bonded to stainless steel straps. Produces 10 watts p.s.i. No special tools or fixtures required for quick, easy installation.



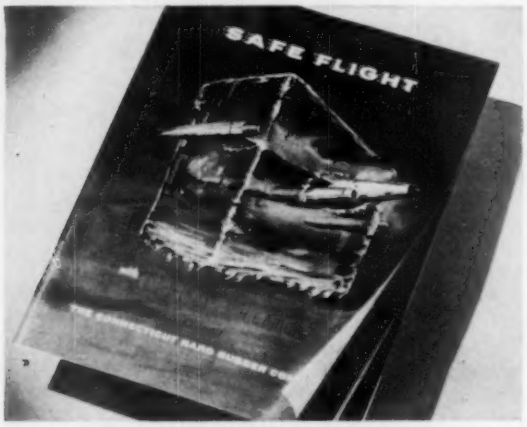
SILICONE RUBBER-COATED .001" GLASS CLOTH FABRIC

This new fabric, known as the *COHRlastic 2800 Series*, is a .001" base glass cloth silicone-rubber-coated to thicknesses of .004", .007", and .010" for increased air impermeability. Extremely rubbery, it remains flexible in temperatures of —70°F to 500°F. Resists mild alkalis, non-oxidizing acids, salts, oils, ozone and weathering. Recommended for electrical insulation, septum coverings, diaphragms, and gaskets.



FABRIC-COVERED SEALS

The outer fabric of the seal shown is dacron, coated with a special silicone rubber compound. The silicone sponge rubber core is securely bonded to the dacron fabric. Extremely rugged, it deforms readily, conforms to contours, and is unaffected by temperatures of —100°F. to 300°F. The tough dacron fabric prevents the seal from tearing loose from rivets, and protects the core from abrasion. Available with various shaped tabs in lengths up to 10 feet. Hollow cores, if desired.



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Cessna CH-1 Helicopter Specifications and Performance

Maximum speed at S. L.	122 mph.
Cruising speeds	100-120 mph.
Rate of climb at S. L. (max. gross weight)	1,000 ft./min.
Maximum CAA certified operating altitude at maximum gross weight	11,000 ft.
Hovering ceiling at max. gross wt. at 95 deg. F.	8,600 ft.
Hovering ceiling out of ground effect at maximum gross weight	6,000 ft.
Range	290 miles
Endurance	3.8 hours
Maximum-gross weight	3,000 lbs.
Empty weight	1,975 lbs.
Useful load	1,025 lbs.
Fuel capacity	60 U. S. gals.
Lifting rotor diameter	35 feet
Number of blades	2
Blade chord	13 inches
Disk loading	3.12 lb./sq. ft.
Engine: Continental FSO-470A	260 hp. at 3,000 rpm. to 10,000 feet. (Net horsepower output after cooling.)
Power loading (total hp./gross weight)	10.2 lb./hp.
Height to top of cabin	85.9 in.
Fuselage length	385 in.
Fuselage width	64 in.

Cessna Shows CH-1 to Military

Cessna Aircraft Company has sent its CH-1 helicopter on a demonstration tour aimed at selling the design to the military services.

The CH-1 is a utility type developed privately by Cessna for military uses, but its chances of getting into production hinge on a substantial military contract. So Cessna is visiting military bases and showing the Army, Navy, Air Force and Marine Corps what the CH-1 will do.

The CH-1 is a simple design that offers the possibility of easy maintenance. Its Continental FSO-470A engine is mounted horizontally forward of the cabin space. The drive system contains five gears, three in the transmission and two in the tail rotor gear box.

Good high altitude performance is claimed for the CH-1. Cessna says that supercharging of the Continental engine allows the CH-1 to maintain power of 260 hp. at 3,000 rpm. up to 10,000 feet.

The CH-1, which has been certificated by the Civil Aeronautics Administration, has a flexible capacity. It can be converted from a four place passenger carrier to a one or two place machine capable of carrying over 500 lb. of cargo. It can also be equipped to carry two litter patients and a medical attendant.

Cessna has equipped the helicopter with skid-type landing gear. The skids are shock-mounted and have wheel attachments for easy ground handling.

The company feels that the CH-1 has commercial application as a small utility aircraft and is conducting a market survey on private use. Cessna is not yet tooled to manufacture the new helicopter, and no production plans have been announced. If it is produced, the CH-1 will be priced $40,000 to $60,000 range.

Bell Gets $1.7-Million HUL-1 Navy Order

Navy has awarded Bell Aircraft Corp. a $1.7-million contract for 10 four-place HUL-1 utility helicopters, larger version of the HTL-6 with higher speed and longer range.

In an announcement last week, Bell said Navy plans to use two for dynamic and static tests. The other eight will be put into service for missions ranging from rescue and evacuation to target spotting and traffic control.

Kits with the HUL-1s will include floats, night flying equipment, internal hoist, long range ferrying gear and internal litters.

Powered by a Lycoming VO-435 engine, the copter can carry a 915-lb. payload. Speed of the HTL-6 is 100 mph., and its still air range is 212 mi.

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SHINE EASIER with

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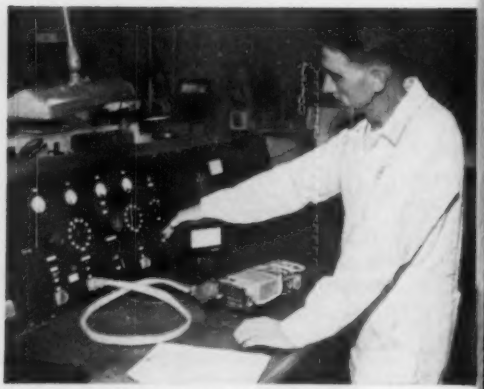
Pan American Strato-Clipper unloads at Honolulu, Hawaii. General Electric engineered electric system on this and other Pan American Clipper planes plays important part in passenger comfort, and confidence in service.

HOW PAN AMERICAN IMPROVES AIRCRAFT

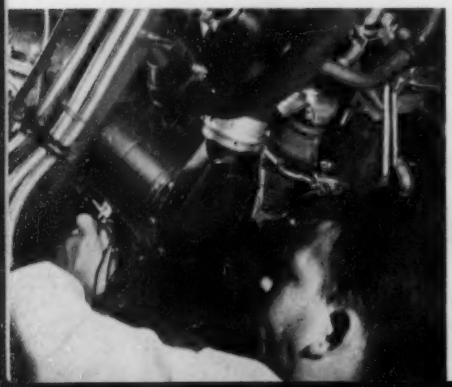
Located in nose of Strato-Clipper, G-E protective panel helps assure electric system reliability.

Arrangement of G-E circuit breakers shows high accessibility—an important part of Pan American's program for easier maintenance of electric systems.

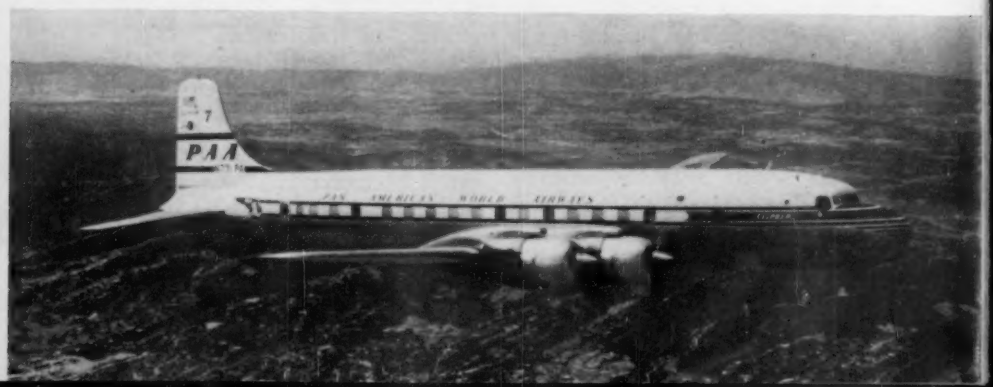


At Pan American's service shops, G-E field engineers assist in helping to improve reliability of electric components.

Long life of G-E aircraft generators has been attained through improved brush riggings and bearings.



The new Douglas Super 7 Clipper makes maiden voyage for Pan American's 50,000th trans-Atlantic crossing, representing 150 million miles of flight. Airline's success with G-E electric systems led to Pan American specifying G.E. for new fleet of "Super-7's."



ELECTRIC SYSTEM RELIABILITY

G-E design engineering combined with first class field service help Pan American increase life of power generating systems.

Dependability of Pan American World Airways' aircraft generating systems is the result of a continuous co-operative effort between General Electric and the airline to increase the life and reliable operation of the G-E components which help make up the system.

This reliability is essential. Pan American's flights travel over jungle, desert, ocean, and rugged mountain terrain in all parts of the world. Any trouble encountered in the plane's electric system could mean time-consuming delays at remote air fields. These could be costly to the airline *and* passengers.

G.E. develops protective system

To meet such problems before they occurred, Pan American called in General Electric to work closely with them and the airframe manufacturers. Conferences were held, and G-E application engineers designed and demonstrated a generator protective system which fulfilled all the requirements. So successful was this system that adaptations were installed on Pan American's new DC-6B's and DC-7B's aircraft.

At the same time these engineering strides were being made, G.E. carried on a continuous field service to assist Pan American's overhaul shops in improving the component performance of the systems. This field service assistance with the airline is still operating today. The result—the G-E electric system has given Pan American the increased safety protection its service demands, as well as better operating performance. That's why they are specifying G-E generator systems on new aircraft purchases.

Service available to you

G-E application and field service engineers can help solve your electric system requirements regardless of where you are located. For further information, contact your G-E Aircraft Specialist through your nearest G-E Apparatus Sales representative today. General Electric Company, Schenectady 5, N. Y. 210-96

Progress Is Our Most Important Product

GENERAL ELECTRIC

This G-E rocket team is developing a wide range of reliable, high performance engines

On the right, lined up on a rocket test stand, are 34 members of General Electric's rocket development team. As representatives of the Company's Aircraft Gas Turbine Development Department, they offer four reasons why G.E. has the capability to develop reliable, high performance rocket engine systems, sub-assemblies, and components of all types.

REASON NO. 1—AVERAGE OF EIGHT YEARS EXPERIENCE PER MAN. All told, this group has over 250 years of experience in high Mach powerplants. This cumulative know-how, so vital in aircraft powerplant work, is assuring faster, more efficient rocket development activity at General Electric.

REASON NO. 2—PROVED ABILITY. These same men actually helped to pioneer modern U.S. rocket engine activity, took part in over 67 German V-2 test flights after WW II. They have designed bi-liquid, liquid-solid, solid and ramjet propulsion systems. They provided the engine for the first large rocket in the Western Hemisphere, developed another with one of the highest specific impulses ever achieved.

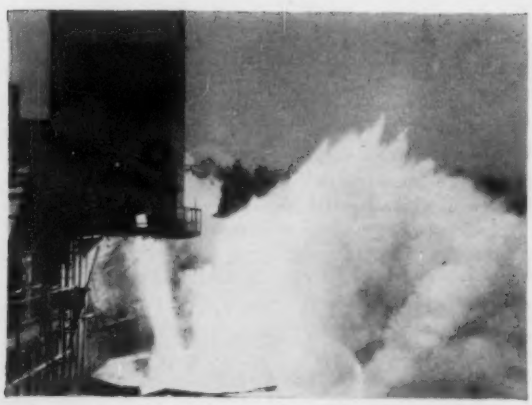
REASON NO. 3—ADVANCED NEW FACILITIES ARE NOW AT THEIR DISPOSAL. General Electric is carrying on a $100 million research and development program on combustion, materials, and components of powerplants for aircraft and missiles. And the rocket engine staff now has access to development facilities such as the AGT Materials Laboratory and the AGT Component Development Laboratory at Cincinnati.

REASON NO. 4—FIRM SUPPORT OF GENERAL ELECTRIC ORGANIZATION. The entire G-E Aircraft Gas Turbine Division with its production capability and G.E.'s nationwide defense sales and service chain now support the design and development of G-E rocket engines. Add up the total. If you would like further information, contact a G-E Aircraft Specialist via your nearest G-E Apparatus Sales Office.

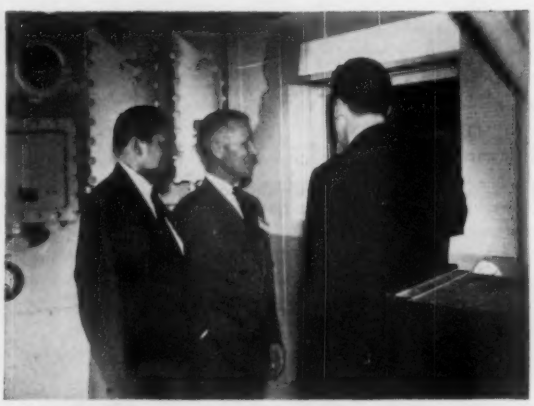
234-1

Progress Is Our Most Important Product

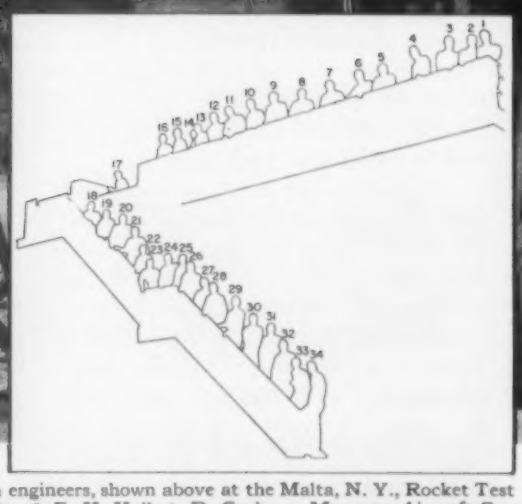
GENERAL ELECTRIC



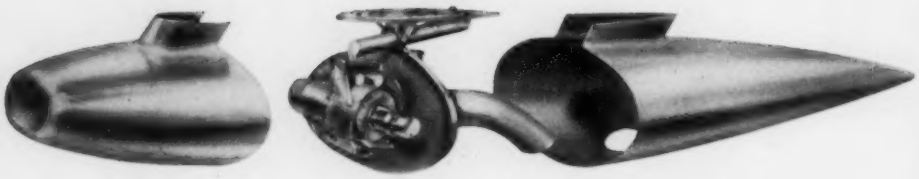
Advanced rocket engine undergoes trial at U.S. Army's Malta Test Station. The first large rocket static test station in the U.S., Malta has highly versatile facilities. Complete instrumentation gives G-E engineers extensive information on engine performance in static tests.



"Consolidating our jet and rocket engine design, development, and production capabilities within AGT is allowing us to make rapid strides in the rocket field," according to Vice President C. W. La Pierre, shown here (left) with G-E President R. J. Cordiner.



Over eight years average experience is the record of these G-E propulsion engineers, shown above at the Malta, N. Y., Rocket Test Station. 1. T. C. Jenkins. 2. H. M. Weber. 3. R. Davidson, 4. F. E. Schultz. 5. E. H. Hull. 6. D. Cochran, Manager, Aircraft Gas Turbine Development Department. 7. T. S. Teague. 8. H. C. Aikens. 9. P. L. Duncan. 10. J. H. Burnham. 11. J. F. Whitbeck. 12. W. S. Kleczek. 13. F. J. Walker. 14. J. Annable. 15. G. S. Emmons. 16. P. Gray. 17. F. W. Crimp. 18. J. A. Cote. 19. A. J. Orsino. 20. R. J. Kazyaka. 21. G. L. McPherson. 22. R. J. Bernadine. 23. C. E. Rugh. 24. L. Cherry. 25. C. P. Beauchamp. 26. R. B. Johnson. 27. B. E. Sells. 28. C. G. Dibble. 29. B. W. Bruckman. 30. J. N. Krebs. 31. E. E. Paulson. 32. Z. O. Sheldon. 33. D. R. Messina. 34. E. I. Finger.



Solar research boosts altitude power output of gas turbine generator sets

FLYING ELECTRONIC TEST-BEDS need plenty of power in flight. So Solar "Mars"® gas turbine auxiliary power units have been ordered for the Convair C-131B. Two APU's, each hung in a pod, will be installed on each plane.

With the Solar units, an ample and versatile supply of electricity is assured. The easily demountable gas turbine driven generators can both be direct current units, or both alternating current, or one of each can be installed. *As much as 30 kw d-c, or 40 kva a-c, can be supplied at 25,000 feet.* This high power output results from major design improvements in the proven Mars engine.

Mars gas turbine APU's are already specified equipment on the Douglas C-124C and the Lockheed C-121C. They have demonstrated their reliability and trouble-free service life by logging thousands of hours with only routine maintenance. Recently these Solar units were uprated from 500 hours to 750 hours between overhauls.

Light, compact Mars APU's can solve your airborne power needs. Write to Solar today for more information about these remarkable gas turbine generators!

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ENGINEERS WANTED. *Unlimited opportunities in Solar's expanding gas turbine program! Write today, giving your experience, to the address in the coupon.*

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When heat, corrosion or difficult specifications are problems, Solar can help you solve them. Solar specializes in the manufacture of precision products from alloys and special metals for severe service. Solar's experience since 1927 is unduplicated in this field.

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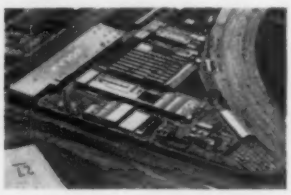
Gas Turbines. *Solar "Mars"® 50 hp engines for auxiliary generator sets, ground carts, portable fire pumps; Solar "Jupiter" 500 hp engines in variable and constant speed models.*

Bellows. *"Sola-Flex"® bellows and expansion joints in many designs from ½ in up to the world's largest, 28 ft in diameter.*

Controls. *Complete control systems utilizing the new Solar "Microjet"® principle for control of gas turbines, jet engines and pneumatic devices.*

CONTRACT PRODUCTION

Current orders include aircraft engine and airframe parts, pneumatic ducting, atomic energy components. Customers include the finest aircraft and industrial companies in the U.S. and Europe.



Plants. *In San Diego (photograph above) and Des Moines. A total of 1,400,000 sq ft of floor space. Approximately 5,000 employees. Annual sales over $65,000,000.*

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INFORMATION

For more information regarding Solar Gas Turbines or any Solar product or service listed above, write Solar Aircraft Company Department B-49 San Diego 12, California

Atomic Weapon Wind Tunnel Nearly Ready

The aerodynamics of atomic weapons will be studied in a new wind tunnel now nearing completion at Sandia Corp., research and development contractor for the Atomic Energy Commission on ordnance.

The tunnel will be a 12-in., intermittent blowdown type with transonic and supersonic capability. Design conforms to standard practice, with the exception of a wide-angle diffuser (for the supersonic throat nozzle section) that uses a choke plate designed by Sandia engineers for smoothing the airflow.

Force and pressure distribution tests can be made, and the tunnel can be used for dynamic stability and flutter studies. Special manometry and high-speed electronic recorders will collect the test data.

Air source is a two-stage intercooled compressor. Main air supply, a 3,000-cu.-ft. tank, is charged at 300 psi. by the compressors. A single charge takes about one hour, is blown down in 20 sec.

PRODUCTION BRIEFING

► **Leach Corp.,** Los Angeles, has been awarded an initial $300,000 contract by Boeing Airplane Co. for precision electrical ground power support equipment to be used in the accelerated B-52 production program. Delivery of equipment was scheduled to start Aug. 1.

► **Cook Research Laboratories,** Division of Cook Electric Co., Chicago, has opened new shop facilities for designing and fabricating special parachutes.

► **Frohman Manufacturing Co., Inc.,** Miami, has purchased the Turbine Products Division of Detroit Broach Co. The division makes jet motor and spline shafts, tie rods and bolts. Facility is located at Boca Raton, Fla.

► **Beech Aircraft Corp.** has opened a new engineering facility at Boulder, Colo. First contracts include two classified projects. Assignments may be given by any of Beech's aircraft activities.

► **General Electric Co.** is building a multi-million apparatus service shop in North Bergen, N. J., to house shop facilities now located in the Greater New York City area. New shop will be completed next April.

► **Thieblot Aircraft Co., Inc.,** has broken ground at Martinsburg Munici-

This new Scott regulator weighs only 2.14 pounds. It is easily mounted with 4 Dzus Fasteners in standard panel space.

Lighter components for lighter aircraft

Military pilots are protected against the dangers of cabin pressure loss in Strategic Air Command B-52 Bombers equipped with the new MB-1 Oxygen Regulator. Automatic, fool-proof operation at deadly altitudes insures a completed mission. This amazing new regulator is a recent achievement of Scott-Firewel developed in conjunction with the Air Force Aero Medical Laboratory. It is designed to meet the requirements of the Air Force Partial Pressure Suit but may also be used with the Standard A-13A Oxygen Mask.

Write today for complete information.

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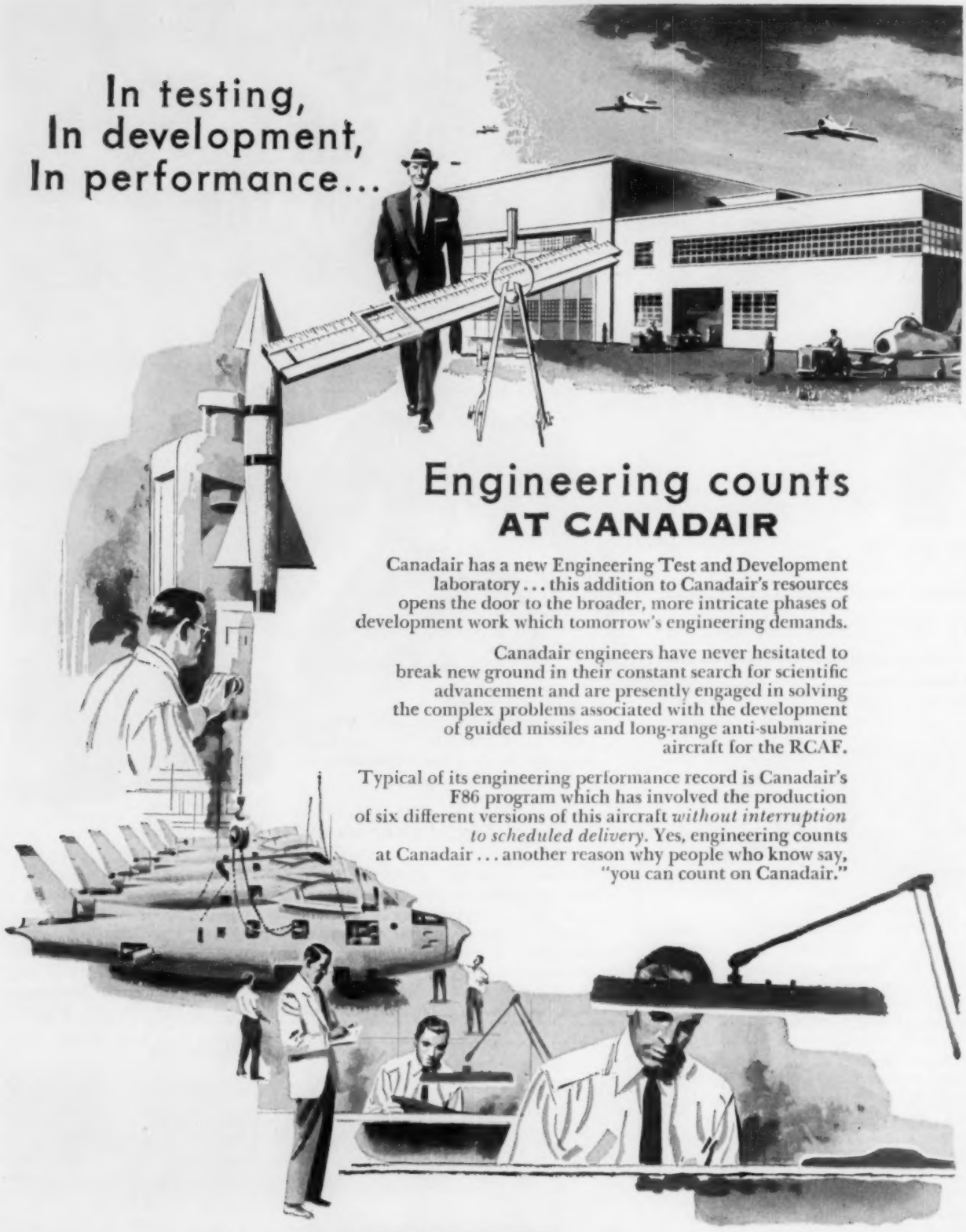

Engineering counts AT CANADAIR

Canadair has a new Engineering Test and Development laboratory . . . this addition to Canadair's resources opens the door to the broader, more intricate phases of development work which tomorrow's engineering demands.

Canadair engineers have never hesitated to break new ground in their constant search for scientific advancement and are presently engaged in solving the complex problems associated with the development of guided missiles and long-range anti-submarine aircraft for the RCAF.

Typical of its engineering performance record is Canadair's F86 program which has involved the production of six different versions of this aircraft *without interruption to scheduled delivery*. Yes, engineering counts at Canadair . . . another reason why people who know say, "you can count on Canadair."

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pal Airport, W. Va., for a new 64,000-sq.-ft. plant to house aircraft modification, assembly, machining, sheet metal work and other fabrication in addition to administration and engineering. Facility is expected to be completed early next year.

► **New addresses: H. E. B. Machine Tools, Inc.,** has moved its executive and sales offices from New York City to larger quarters at 708 Clare St., Lansing, Mich. . . . **Synthane Corp.,** Oaks Pa., maker of laminated thermosetting plastics, has moved its Rochester, N. Y., sales office to 137 W. Commercial St., East Rochester, N. Y.

► **Timken Roller Bearing Co.,** Canton, Ohio, has earmarked $850,000 for further expansion of its Bucyrus plant, bringing total expenditures to build up facilities to more than $10 million. Entire program is expected to be completed by the end of next year.

► **Harrisburg Steel Corp.** and Precision Castings Co. have merged. With the new acquisition, Harrisburg's operations will cover 31 plants and sales volume is expected to double to about $60 million.

► **Extruded deck cooling panels** which circulate sea water to dissipate heat from exhaust blasts of carrier-based jet planes are produced at the Halethorpe extrusion plant of Kaiser Aluminum & Chemical Corp., Oakland 12, Calif.

► **Production testing problem** was solved for Sundstrand Machine Tool Co.'s Aviation Div., Rockford, Ill., by use of specially designed R500 hydraulic hose made of fluorocarbon-type resin instead of conventional rubber materials. Latter failed under equipment test conditions which circulate hydraulic fluids at 250-350 F. Corrosion-resistant R500 is manufactured by Resistoflex Corp., 39 Plansoen St., Belleville, N. J.

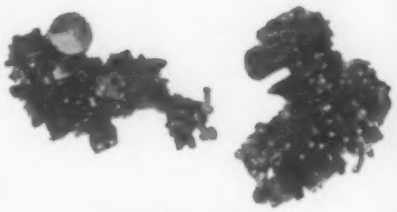
► **Panellit, Inc., Skokie, Ill.,** has formed a new Instrument Services Division, to handle consulting and installation in the instrumentation and automation fields.

► **Sales and service branch office** of Cleveland Pneumatic Tool Company has been established at 3000 Hempstead Turnpike, Levittown, N. Y., under the direction of T. J. Baker.

► **New York Air Brake Co.** has appointed Aviation Electric Ltd., Montreal and Standard Aero Engine Ltd., Winnipeg, Canadian representatives for Stratopower aircraft hydraulic pumps manufactured by the company's Watertown Division.

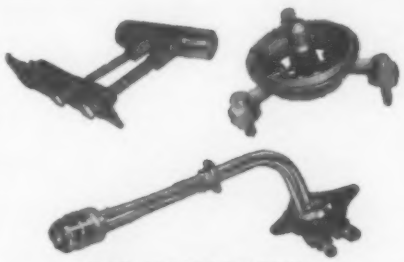
XLD
EX-CELL-O for PRECISION

Ex-Cell-O Precision at Production Prices

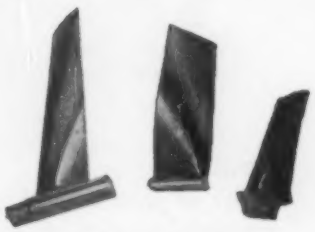


FUEL CONTROL AND METERING ASSEMBLIES

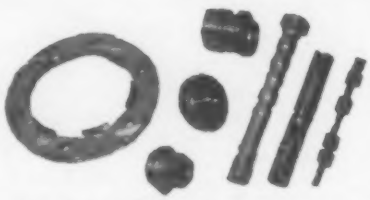
HYDRAULIC & PNEUMATIC ACTUATOR ASSEMBLIES



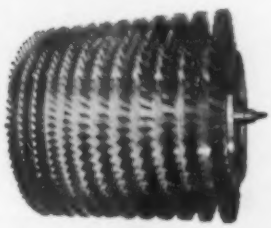
FUEL NOZZLES FOR JET ENGINES



JET ENGINE BLADES



MISCELLANEOUS AIRCRAFT AND COMMERCIAL PRECISION PARTS



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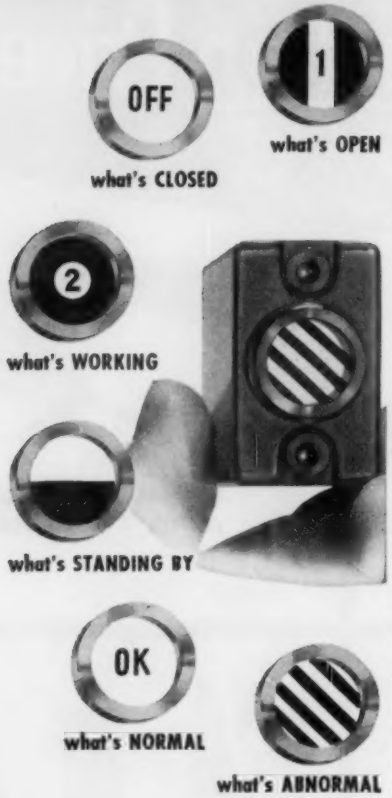

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LETTERS

More on Lights

As a practising airline pilot who has given a lot of time during the last five years to studying problems associated with bad visibility landings, I have followed the recent letters in your magazine, dealing with the "Slopeline versus Centreline and Bar" controversy, with great interest.

However, the letter written by Mr. Cory Pearson, under the heading "Pro Slopeline Lights," published in your issue of June 13th, appears to me to contain so many misconceptions—and not a few innuendoes directed against professional airline pilots—that, in the interests of truth and justice, I feel compelled to enter the lists.

I, too, must plead guilty to "an evident and marked bias" toward the centreline and bar pattern, as this pattern, now installed at a large number of major civil airports in Europe, is the only one on which I have had satisfactory operational results in what airline pilots consider to be low visibilities. I have had no operational experience in bad weather of the slopeline installation.

I have however, sat on several committees of airline pilots of international bodies, when we have attempted to lay down operational criteria as to **what the pilot wants** from an approach light system. The decisions reached have always been overwhelmingly in favour of the centreline and bar.

It would seem that Mr. Pearson is wilfully misunderstanding Mr. Calvert when, in the second paragraph of his letter, he deals with accidents occurring during approaches made on centreline and bar systems. To dot every i and cross every t, Mr. Calvert should perhaps have said: "There have been no accidents resulting from MISINTERPRETATION OF GUIDANCE GIVEN TO THE PILOT BY THE APPROACH LIGHT SYSTEM, during any approaches made on the centreline and bar system." If an aircraft crashes during the approach due to engine or structural failure, it seems a little unfair to blame this on the approach light system. Whilst unable to comment on the accident referred to at Newark on Oct. 16, 1951, I believe the accident-free record of centreline and bar installations in Europe is still valid.

In the paragraphs under the sub-heading "Pilot Skills," Mr. Pearson, (who I believe is not a practising airline pilot), makes some very dangerous assumptions, with which, I submit, few members of the profession would agree.

A pilot certainly has to be trained (and a very lengthy and expensive process it is), and he has to be kept in training—not only by the everyday use of his skill and knowledge but also by special bi-annual "refresher flying" and Instrument Rating Renewal Checks. This also is a most expensive business for the airline. Airline pilots favour the centreline and bar system because no previous training nor constant (and expensive) training is needed to interpret its indications. This is because the system is built up from the "skeleton" of the **same visual clues** which are used during normal approaches in good visibility. In essence, so long as a pilot can recognise a right angle when he sees one (which is something all of us—not only pilots—are trained to do from earliest infancy, when we first learn to walk), he cannot go wrong on this system. The visual indications provided to the pilot are both **simple and unambiguous**, and therefore SAFE. Can Mr. Pearson seriously suggest that we should throw away these advantages and somehow obtain expensive training on an "unnatural system" and then somehow also obtain the constant practice needed to keep up the standard? (The cross-pointer needles of the ILS gives an example of "unnatural" indications, on which the pilot not only needs considerable initial training but also constant practice to maintain his skill.)

"Effect of Cut-off." In his paragraphs under this sub-heading, I confess I am unable to follow Mr. Pearson's reasoning. I am not sure that he is not mixing up what pilots call slant visual range with what they call "minimum visual segment". The first, I think, is called by Mr. Pearson just "visibility"; but to pilots it is the line of sight from the cockpit to the **furthest** approach light visible. The second, I think, is referred to by Mr. Pearson as "500 feet of bars visible" and refers to the segment of the approach light system "carried" by the pilot as he descends the glidepath. The length of this segment is defined at its forward limit by the slant visual range and at its aft limit by the angle of the cockpit cut-off.

Slant visual ranges are extremely hard to measure under operational conditions (especially under those of shallow radiation fog), and because of this a lot of misconceptions have arisen, both as to the magnitude of the slant visual range and as to the effect of cockpit cut-off. Landing minima presently in use in Europe at many airports are stated in terms of Runway Visual Range (not to be confused with Meteorological Visibility), and for many operators are of the order of 500 yards. Landing in a fog of this density over modern approach light systems of the centreline and bar type, the pilot has a slant visual range when over the lights of some 3,000 to 4,000 feet. Under these conditions, with a cockpit cut-off of some 12 degrees, (a figure attained by almost every commercial airliner today when in the approach configuration), the pilot will carry a visual segment of from 500 to 1,000 feet of approach lights once he gets visual reference.

Increasing the cockpit-cut-off to more than 12 degrees has remarkably little effect on length of the visual segment carried, as will be apparent to students of geometry.

"Garden-Party Approaches." In his final paragraphs, I feel that Mr. Pearson is being rather unfair to my American pilot colleagues. Surely he is aware that U. S. legislation still insists on tying together critical

Aviation Week welcomes the opinion of its readers on the issues raised in the magazine's editorial columns. Address letters to the Editor, Aviation Week, 330 W. 42 St., New York 36, N. Y. Try to keep letters under 500 words and give a genuine identification. We will not print anonymous letters, but names of writers will be withheld on request.

new Boeing jet tanker to stretch America's Air Arm with mid-air refueling

Almost daily, continuous flights halfway around the World are being made because huge KC-97 tankers meet bombers for refueling in mid-air. Tankers like the Boeing KC-135 will bring "targets" on faraway Continents within striking distance. The new Boeing KC-135 will haul extra large cargoes because *added strength* with *less weight* is possible with metal honeycomb construction. Kawneer is helping build more planes like the KC-135 *faster* because of excellent metal bonding facilities to produce any kind of honeycomb assembly. Our experience in metal bonding honeycomb will be helpful to you in designing new applications of this material. This is another example of how you can benefit by Kawneer's integrated engineering and manufacturing service.

Kawneer will produce the ailerons for the KC-135 utilizing honeycomb sandwich construction

Illustrated here is the Boeing 707 Tanker-Transport prototype of the new KC-135.

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heights (or cloud-base) and meteorological visibility in fixed increments: 400 and one, 300 and ¾, 200 and ½, etc. And as most passenger operations are still tied to 300 and ¾, this effectively prevents most airline pilots from even attempting approaches in the lower visibility brackets?

In Europe, both operators and legislators have recognised that critical height is mainly dependent on the overshoot characteristics of the aircraft coupled with the errors in the pressure altimeter, whilst the visibility criterion is mostly dependent on what the pilot can ACTUALLY SEE. For this reason, it is now quoted in terms of runway visual range and NOT meteorological visibility and varies according to the approach and runway lighting system in use.

I do not think that many airline pilots, who have successfully completed landings in Runway Visual Ranges as low as 500 yards, would agree with Mr. Pearson's definition of this as a "Garden-Party approach." To make such a landing in a modern heavy transport aircraft, with a wing-loading of upwards of 50 lbs/sq. foot and an approach speed of the order of 140 m.p.h., demands a high degree of concentration.

To make such a landing, often when tired at the end of a long day, demands, in the writer's opinion, an approach light system which the pilot knows is safe and unambiguous to use.

Finally, Mr. Pearson is quite wrong in imagining that ANY approach light system is the answer to "All-Weather Operation." In the centreline and bar system we already have APPROACH lights, with which it is possible to make approaches off which one cannot land, as the visual indications from the RUNWAY lights break down. Even if this problem is solved, the pilot must still be able to see enough to taxi off the runway to the ramp. And at most airports, the coach drivers still have to be able to see enough to drive their coaches to and from the airport.

PETER E. BRESSEY
31 Blakesley Avenue
Ealing, London, W.5.

Capt. Peter Bressey, veteran British European Airways pilot, is known both in the U. S. and Britain for his aviation safety work within the British Air Line Pilots Assn.—ED.

Vertical Gyro

In your July 18, 1955, publication of the article Cockpit Viewpoint by Capt. R. C. Robson, the following appeared:

"Today's artificial horizon is almost as bad. Some airlines use instruments which are not even designed to show level flight after a bank in much less than 20 minutes. Try that one at 200 and ½!"

It is obvious that you are not aware of the meteroic design of the Lear, Inc., at Grand Rapids, Mich., vertical gyro indicator used by the USAF and U. S. Navy in their new jet aircraft. Here is design men can fly by. Through the application of a unique electro-mechanical erection system Lear vertical gyro is free of errors in a bank. This is errorless attitude to be desired and sought by the airlines.

THOMAS WARD
90 Carter Street
Newburgh, New York

Design News from Bridgeport Thermostat

SEAMLESS METAL BELLOWS AS SMALL AS ¼" DIAMETER

For miniaturization, Bridgeport bellows in ¼" and 5/16" diameter sizes offer many new opportunities to design engineers. These tiny, seamless metal bellows are hydraulically formed of brass, phosphor bronze, beryllium copper, monel and other metals. A wide range of reactions and characteristics is available.

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Bridgeport specializes exclusively in metal bellows of all types and sizes, and complete bellows assemblies. Savings in time, trouble and money can be made by buying complete bellows assemblies . . . let Bridgeport show you how.

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☐ Full details on new, small-diameter bellows
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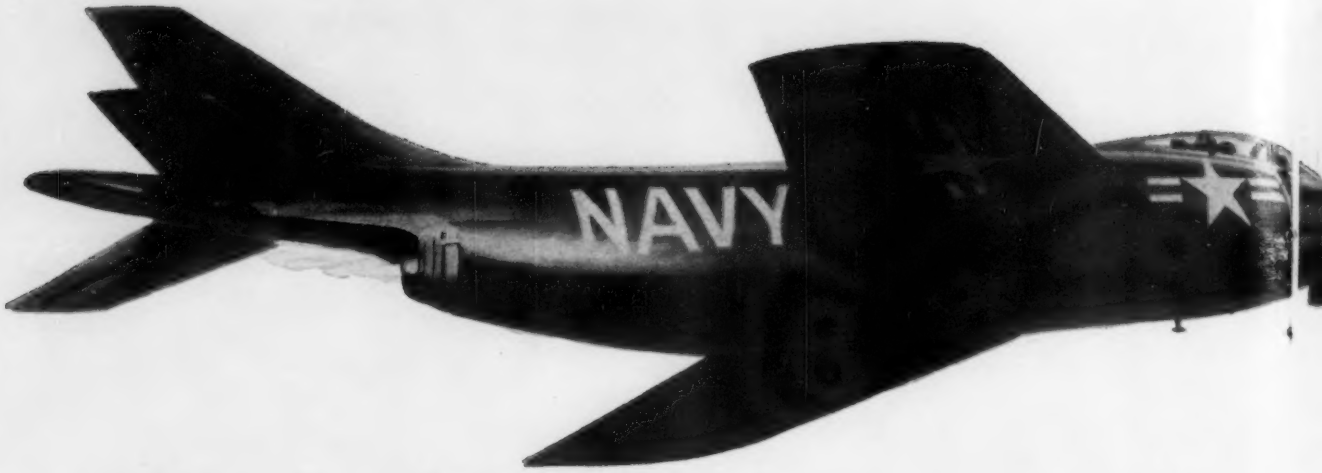

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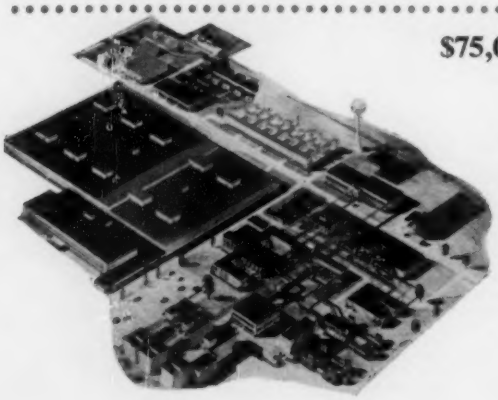


$75,000,000 Expansion of Allison Research and Test Facilities

To provide development facilities necessary for leadership in the aircraft engine field, General Motors now has under way a $75,000,000 expansion in its long-range engineering program, which will give Allison the most modern gas-turbine aircraft engine development center in the world.

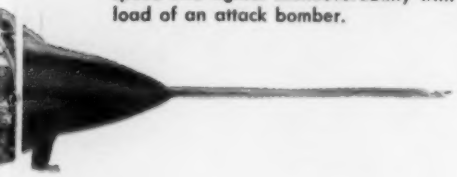
This program will nearly double the 500,000-square-foot area now devoted to engine research, and require approximately a 40% increase in engineering and technical personnel. It has as its long-range purpose the development of gas-turbine aircraft engines that will far exceed today's high standards of performance in military planes.

Unusual opportunities for Engineers and Technicians.
Write: Technical Employment Section

ALLISON DIVISION OF GENERAL MOTORS, Indianapolis, Indiana

McDonnell F3H Fighter

Latest version of the Navy's swept-wing McDonnell F3H Demon is powered by an Allison J71 Turbo-Jet engine with high-altitude afterburner. This all-weather carrier-based fighter combines interceptor speed and fighter maneuverability with the military load of an attack bomber.



the Blue

J71 Turbo-Jet Engine

WINNING its wings in the Navy is the Allison J71 Turbo-Jet engine which powers these two great new additions to our nation's air fleet.

The J71 has been accumulating test hours for several years, and now can be identified as an engine in the 10,000-pound-thrust class, following successful completion of the most exacting test schedule ever required of an aircraft engine.

A single compressor engine of simple design and construction, the J71 incorporates the same qualities of ruggedness and dependability demonstrated in Allison Turbo-Jet engines which have flown more than six million hours. One of its outstanding features is ease of maintenance and repair—the same characteristics which mark its predecessors, the J33 and J35.

The ability to design and build gas-turbine aircraft engines in volume, at economical cost, explains why Allison Turbo-Jets and Turbo-Props today power more different types of U. S. military planes, missiles and helicopters than gas-turbine engines of any other make.

Martin XP6M SeaMaster

World's first multi-jet attack seaplane, the Navy's Martin XP6M SeaMaster, is powered by four Allison J71's with afterburners. It is in the over 600 MPH class and is designed to cruise normally at 40,000 feet.

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"She not only thinks—she even dreams!" These are the words which express the full implication of NIKE, the new guided missile that has a vital part in defense planning. NIKE seeks, locates, and destroys an airplane... another missile... anything that flies. The deadly reliability of her guidance system depends in part on *SYNCHROS* which translate electrical impulses into positioning data.

NIKE

Based on their experience, research facilities, and performance in volume production, the Precision Components Division of Norden-Ketay was chosen by Western Electric Company, prime contractor, to develop and produce special *SYNCHROS* for NIKE. Norden-Ketay also serves most of the other leaders in automatic control.

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"Winged Victory" is the familiar name of this Greek statue of NIKE, goddess of victory, found at Samothrace, (circa 300 B.C.). Her name (pronounced 'Ny-Key') was selected by Army Ordnance as most appropriate for the ground-to-air missile developed for them by Bell Telephone Laboratories. Norden-Ketay is proud to have been chosen as an integral part of the team which produced NIKE.

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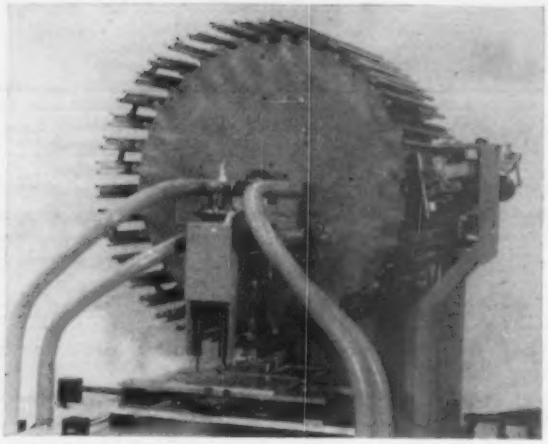
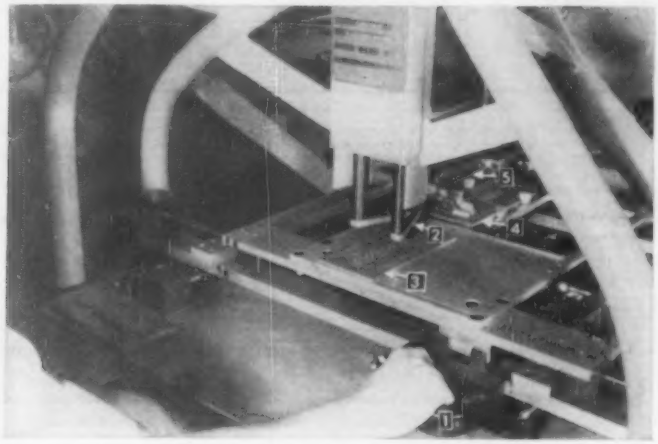
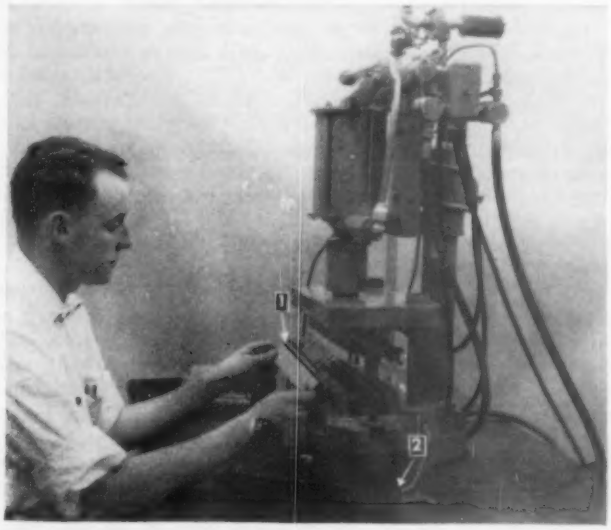




NEW MECHANIZED COMPONENT PLACEMENT machine, especially designed by General Electric for small production runs, can be manually operated but eventually will operate from punched-tape instructions. Operator moves handle (1) to position stylus (2) relative to master template (3) which positions printed circuit board (4) so placement head can install component extracted from magazine (5).



COMPONENTS ARE MASS-LOADED into magazines by preparation machine (left) that simultaneously trims and forms their leads. Magazines are then manually loaded into one of 40 stations located around the periphery of the component placement machine (right).

GE Meets Competition with Automation

By Philip J. Klass

Utica, N. Y.—General Electric has taken the wraps off new mechanized assembly machines that will make its recently formed Light Military Electronics Equipment Division here one of the most completely "automated" avionics producers in the country.

The new machines are designed specifically for small production runs so characteristic of the avionics industry. LMEED specializes in airborne radar, navigation, communication and data transmission systems.

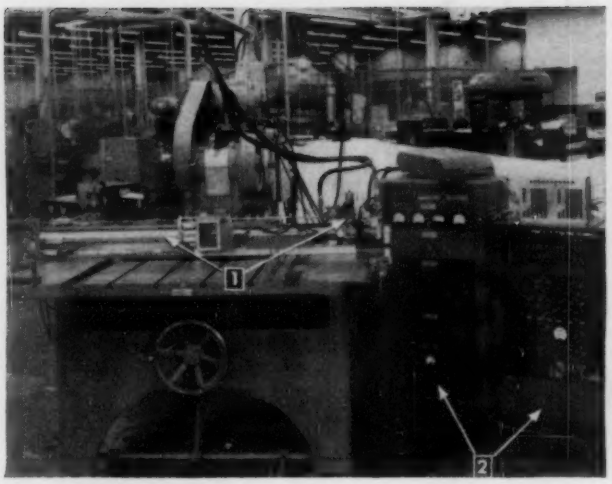
LMEED's new component placement machine, in its present form, is manually operated by means of a pantograph and template, similar to a Weidemann punch press. However, LMEED expects to have the machine operating automatically soon with servo controls that will guide the process through punched tape instructions.

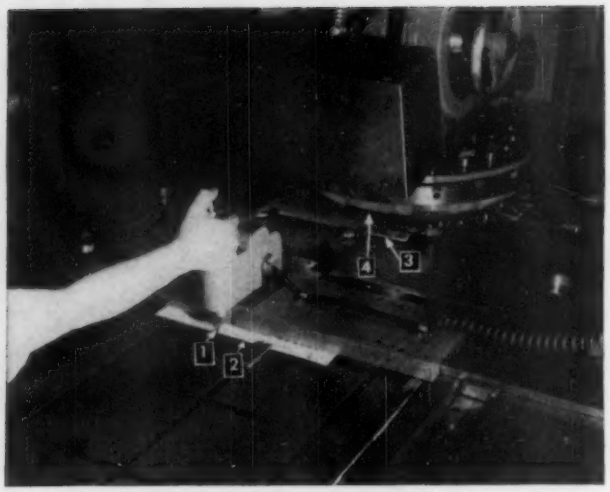
In addition, the Signal Corps-sponsored Automatic Component Assembly System (ACAS), developed by GE (AW May 2, p. 42), is slated for service evaluation here. Automatic inspection and functional test of end products, is already in use at Utica. LMEED expects to have new tape-programmed punch presses also in operation by year-end.

Answer To Competition

LMEED officials believe that mechanization of key manufacturing processes, common to a wide variety of avionic equipment, is fully justified both from the standpoint of economics and improved product quality. This is despite the small production runs normally found in the avionics and military electronics industry.

The new $18-million, 440,000-sq.-ft. LMEED facility, and its mechanization





SIMILAR WORK MOTION USED in the conventional Weidemann punch press (left), which also employs pantograph-stylus-template arrangement, will enable General Electric to use the same punched-tape servo control system to automate both the component placement machine and punch press. Early model of an automated Weidemann press, operating from punched cards, is shown in the right-hand photo.

program, are the company's answer to the increased competition for military production contracts which GE and other old-line firms are encountering in the present buyers' market. With large development engineering staffs and facilities, firms like GE sometimes have trouble competing with the low-overhead, "loft-type" operators with small engineering staffs and minimum investment in facilities.

By going to mechanization, LMEED expects to cut manufacturing costs considerably and simultaneously to offer the military an improved quality product, an important byproduct of mechanization and automation.

Automation By Evolution

LMEED's program is a step-by-step evolutionary project rather than a revolutionary one aimed at over-night transition to an automatic factory, H. F. Konig, general manager, told AVIATION WEEK. Automatic inspection of assembled printed-wire boards and functional testing of completed equipments have been in use for many months.

Prior to launching its mechanized assembly program, LMEED made an economic analysis of several different approaches to the problem as it was related to its own avionic and military electronic production needs. LMEED's survey indicated that:

- **Batch size** of printed board sub-assemblies produced at Utica averaged 25 to 40 units per run.
- **Number of components** per board averaged around 45.
- **Nearly 80% of the components** had axial leads making them readily adaptable to mechanized assembly, i.e., carbon resistors, tubular and mica capacitors. Of the remaining 20%, half were vacuum tubes.

As a result of this study, LMEED rejected the "in-line" type of mechanized assembly system, typified by General Mills Autofab and United Shoe Machinery systems. (AW March 21, p. 60; May 2, p. 44). These employ a battery of machines, each of which installs a single component in a printed board. LMEED's studies indicated that because of change-over time, the "in-line" system was better suited to high production items where lot sizes exceeded 100 units.

The GE-developed ACAS is designed for small production runs. However, LMEED engineers, on the basis of experience gained in the ACAS program, and by adopting a system of modular dimensions for component locations, believed they could design a less costly machine for LMEED's own immediate needs.

"Unitized" Auto-Assembly

GE's new "unitized" mechanized assembly line is a sort of hybrid the "in-line" and ACAS approaches. The system consists of:

- **Component preparation machine,** which bends component leads, trims them to desired length, and loads them into magazines in one operation (see photo, p. 61). Each magazine holds 28 to 68 identical components, depending upon component size. Components are manually loaded into a fixture which is fed manually to the preparation machine.
- **Component placement machine,** consisting of a large horizontal drum with 40 component magazine loading stations located around its periphery (see photo, above, left). Each station is loaded manually with one to three magazines filled with components, as shown on p. 61.

A printed-circuit board is inserted in the machine in a pantograph arrangement which can be positioned in an "X" and "Y" direction (like a Weidemann press) by manually positioning a master template relative to a stylus (see photo, p. 61). When the operator indexes the stylus to the first hole in the master template, the board is positioned under the placement head to receive its first component.

When the operator pushes a button on the handle which positions the stylus, the placement head extracts a component from the magazine in the first station, thrusts its leads into appropriate holes in the board and clinches the leads.

The operator repositions the stylus to the next hole in the template (moving the printed board to a new position), and simultaneously actuates a foot treadle which causes the horizontal drum to index around one station. The complete cycle is then repeated. With the present 40-station drum, up to 40 different components can be installed on one board. Printed boards are manually inserted in the machine, but this step eventually may be mechanized.

Similarity of "work motions" between the component placement machine and the punch press was planned that way. This enables GE to employ the same basic punched-tape servo system to fully automate the pantograph movement in both the component placement machine and the punch presses used to poke the required holes in the printed boards. The punched tape control system, currently under development, is expected to be far speedier than the earlier one developed for experimental application to a Weidemann press (photo above, right).

Meet Robert Ashe,
John Lawton and H. L. Newby

Westinghouse AGT supervising field service engineers. Ashe has the Eastern area out of Norfolk, Lawton the Central area out of St. Louis and Newby the Western area out of Los Angeles. These men and the field service engineers working with them are important reasons why:

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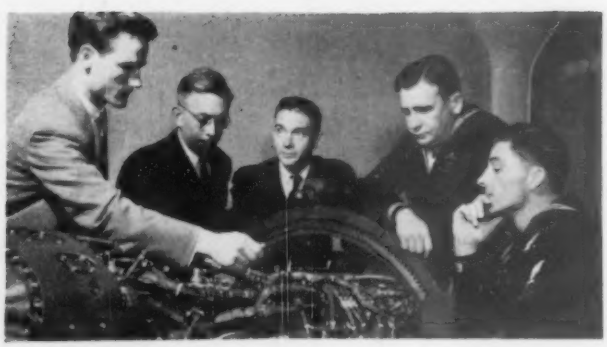

Shown here is a service school conducted at the Westinghouse Aviation Gas Turbine Plant in Kansas City. Its purpose is to train military personnel in the servicing of Westinghouse engines. This activity is typical of Westinghouse service engineering. J-91034-A

For more information on how field service engineering contributes to aircraft performance . . . turn the page

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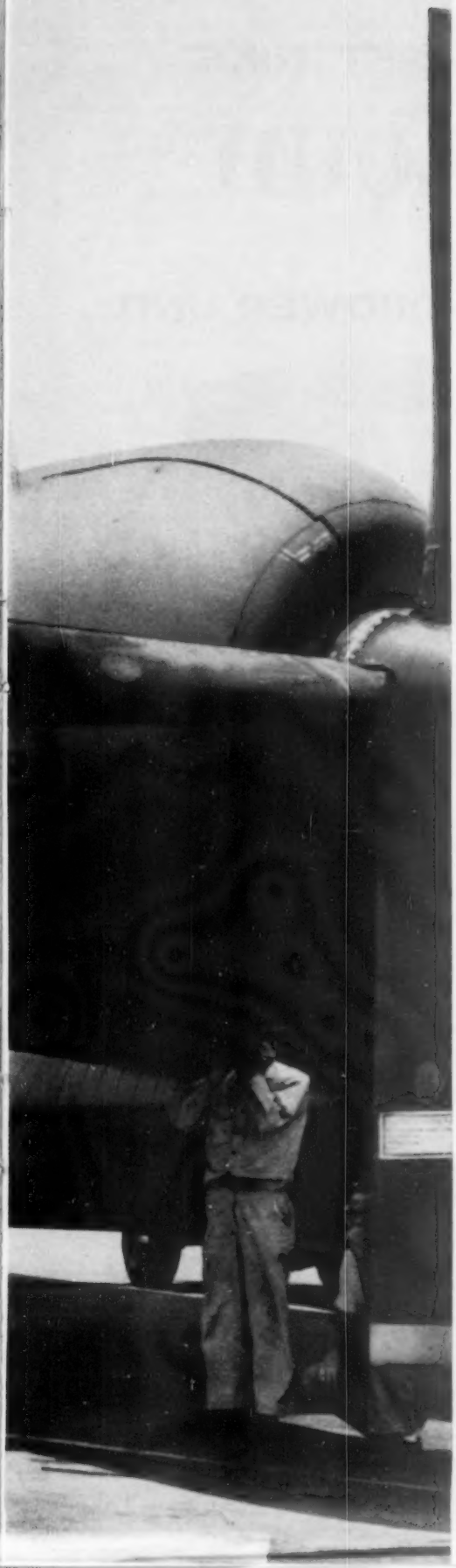

Engineering follow-through is a specialized part of Westinghouse service designed to help you get the best possible performance out of jet engines. J34 engines have had the allowable time between overhauls increased to 1080 hours and some engines have actually run 1000 hours. Further, these engines have been certified by the CAA for commercial operation.

At the core of Westinghouse engineering follow-through are the field service engineers. These men are in constant contact with engine users everywhere and feed back data concerning the product to design engineers. They concern themselves, for example, with such problems as engine icing. They consult with pilots and tell them how to get the most out of an engine. Operating personnel benefit from consulting with these men regarding practical engine analysis to improve engine performance.

This new concept of field service engineering is an extra service from Westinghouse that is designed to get the most out of Westinghouse engines and to help you bring tomorrow's aircraft . . . One Step Closer. J-91034-B

Westinghouse field service engineers help operating personnel conduct engine check-out prior to initial flight of Lockheed's P2V-7 Neptune. Podded auxiliary turbojets permit increased speeds and heavier loads.

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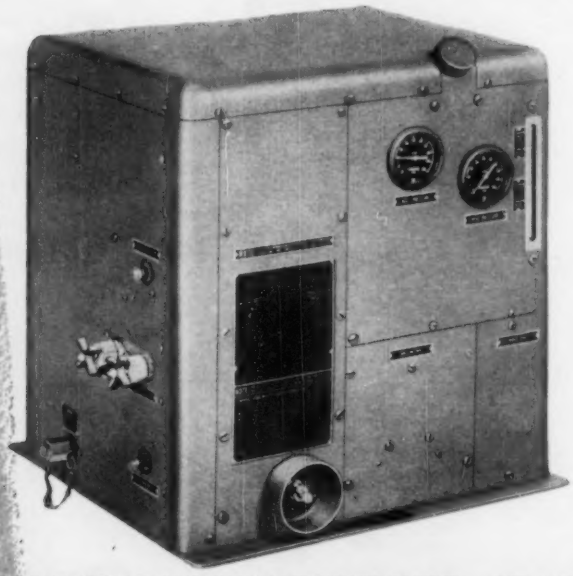

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Baltimore, Md.

as part of GE's ACAS program (AW Sept. 8, 1954, p. 42).

Output Rates

Present indications are that the human-operator (semi-automatic) version of the component placement machine will be able to install 30 components per minute, a rate which LMEED engineers hope to double when the punched-tape control is added. This compares with a manual component placement rate of:

- **4 per minute** achieved in typical previous LMEED production.
- **10-12 per minute** achieved in the radio-TV industry.
- **16 per minute,** normally considered the maximum possible human placement rate.

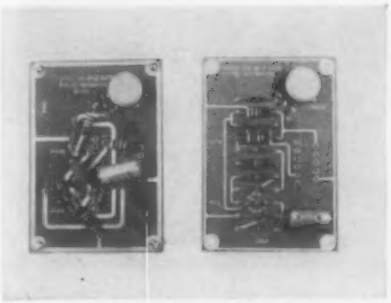
LMEED'S "unitized" machine cannot match the output of an "in-line" system like Autofab, with perhaps 35 placement heads. However, change-over time for the GE machine is expected to run only one-third that for Autofab, Statt, manager of manufacturing engineering at Utica, told AVIATION WEEK.

For this reason, Statt figures that the GE system can turn out a greater number of printed boards than an "in-line" system where average lot size is around 40 or less, as it is at LMEED. Where lot size exceeds 100 units per run, the "in-line" system has a decided edge, as shown in the chart, below. In terms of initial investment, Statt believes that GE can build three of its own component placement machines for the price of one 35-head in-line system. (The GE machine development has been financed entirely with company funds). GE's machine imposes additional design disciplines on LMEED engineers by requiring that sub-assemblies be laid

LOT SIZE AND ANNUAL REQUIREMENTS DETERMINE WHICH TYPE of MACHINE TO USE

LOT SIZE	YEARLY PRODUCTION CAPABILITY		
	INLINE	UNITIZED	ACAS
15	24,000	45,000	78,600
25	41,000	57,000	80,000
100	156,000	78,000	81,600
∞	2,400,000	90,000	82,300

THREE DIFFERENT TYPES of mechanized assembly systems are compared. Production capabilities reflect differences in set-up and change-over times.



FOR MECHANIZED COMPONENT placement machine, leads must be located in standardized grid increments (right), in contrast with random locations possible with conventional manual placement (left).

out so that component leads are located to standardized dimensions, according to M. R. Johnson, manager of engineering. LMEED uses a standard increment of 0.1 inch for its component location grid system, with increments of 0.8 and 1.2 in. for spacing between component leads. A comparison of two functionally identical sub-assemblies, one using the new incremental grid layout, are shown in photo above.

Automatic Test Cuts Costs

LMEED already has started to reap significant benefits, including major cost reduction, from its automatic inspection and functional testing. Expense of testing an equipment by previously used manual means often exceeded its original fabrication cost, Statt says.

General-purpose automatic testers also largely eliminate the previous requirement for building special testers for each new equipment. Such devices sometimes cost more than all other manufacturing tooling required, and in one LMEED job they totaled $60,000.

About a year ago, LMEED put into use a new automatic tester, called Supertester, developed by Color Television, Inc. (AW Feb. 1, 1954, p. 50), for inspection-testing of the more than 100 different types of printed-board assemblies which LMEED turns out. The dip-soldered board is placed in a special fixture which makes electrical contact at key points, then the CTI tester automatically runs through a sequence of tests (see photo, p. 71). These may include checks for continuity, leakage, voltage, impedance, resistance, gain, or phase relationship.

When the CTI Supertester finds a fault or component outside predetermined limits, it automatically prints out a code number on a strip of paper which indicates which component or circuit is faulty, sounds a warning buzzer, and then proceeds with testing. The unit can perform up to several tests per second, depending upon the type involved. The largest sub-assembly which

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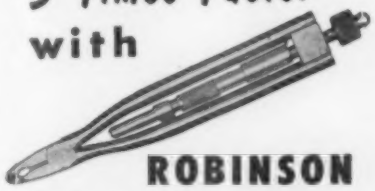

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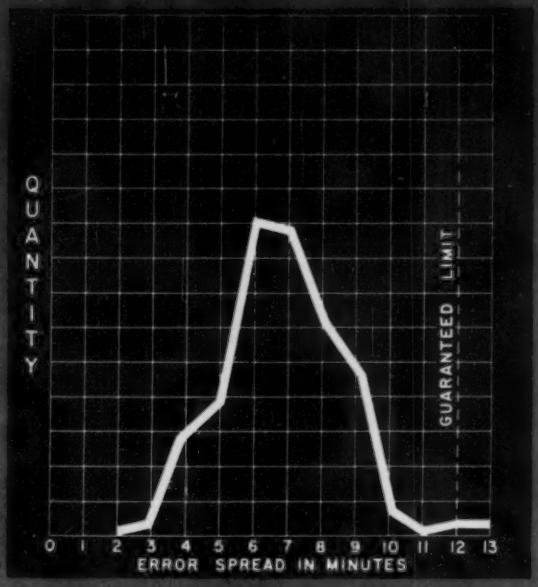

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CLIFTON PRECISION PRODUCTS CO. INC.
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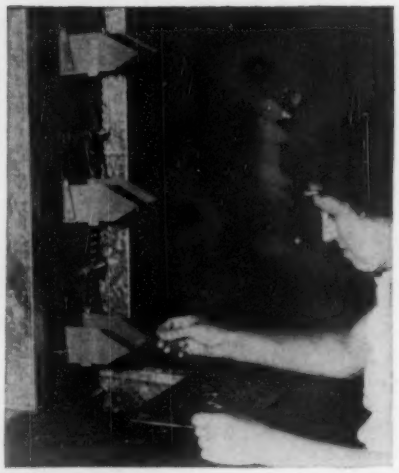


FERRIS-WHEEL type of conveyor, with a different type component in each tray, speeds component placement in boards.

LMEED turns out requires only 72 seconds for complete check-out, Statt says.

The printed test record instantly pinpoints sources of trouble in rejects, and for units which pass, the record is accepted by Government inspectors.

Using a single CTI tester, which cost about $13,000 with all accessories required to handle a variety of different boards, LMEED is able to inspection-test all the boards turned out in the entire Utica plant. This requires only one part-time operator, with no special technical skills. The same testing operation previously required five technically trained operators and 14 non-technical personnel.

By employing a second shift on the CTI tester, Statt figures that a single unit could handle the full output of LMEED's facility, which has a capacity of $75-100 million per year.

The CTI tester has proven so reliable, Statt reports, that out of a typical batch of 500 boards tested, only a couple got by the CTI unit which later were rejected in operational tests of the overall equipment. These failures were due to a potentiometer whose wiper made intermittent contact only at certain points in its travel.

Greater Versatility Coming

Versatile as the present CTI Supertester is, LMEED's engineers have ideas for improving it. At present, when a different batch of printed circuit boards is to be tested, it is necessary to plug another "program adaptor" head into the CTI tester, as well as another fixture for connecting to key points on the new printed boards. Although this change in set-up requires only a few seconds, it has the disadvantage of requiring a large number of different heads and fixtures. LMEED engineers expect to come up with a

DOW CORNING CORPORATION

Silicone News

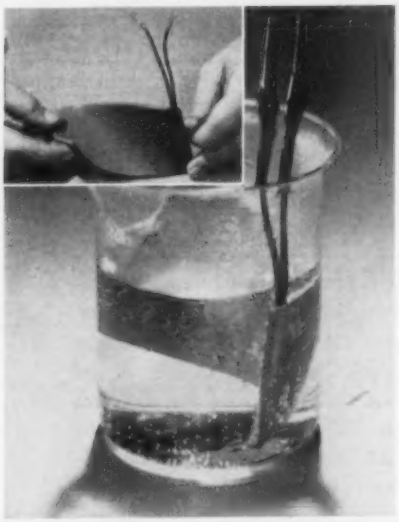
FOR DESIGN ENGINEERS

SUNBEAM "FRYPAN": CASE HISTORY OF AN ADVANCED DESIGN MADE PRACTICAL BY DOW CORNING SILICONES

Ingenious design and resourceful use of materials is reflected in the Sunbeam Automatic Frypan, an attractive and original new household appliance, which combines the appeal of a built-in source of controlled heat with the convenience of easy, thorough washability.

These ideal features were made practical through use of Dow Corning silicones. The completely enclosed lead and thermocouple wiring, for instance, is insulated with Silastic, the Dow Corning silicone rubber. Silicone-glass sleeving is also slipped over the wires to assure maximum dependability at operating temperatures in the range of 450 F. And the terminal block to which they are connected is a heat resistant silicone-glass laminate.

Although the Frypan may be almost totally immersed in water, the electrical connections at the base remain dry and easily accessible inside a terminal box sealed with molded Silastic. Extensive research and testing, including several thousand actual immersions, have proved that this gasket maintains a watertight seal even after prolonged exposure to temperatures in the range of 450 F. *No. 42*



Silastic Insulates, Protects Flexible Woven Heater Pad

Proof of the effectiveness of Silastic* encapsulation is found in the performance of this 115-volt flexible heater woven and insulated by the Haddam Manufacturing Co., Haddam, Connecticut, for a classified aircraft use. The combined thermal stability and conductivity of Silastic is so great that the heater will operate indefinitely at temperatures high enough to boil the water in which it is totally submerged. *No. 43*

*T.M. REG. U.S. PAT. OFF.

Silicone Fluid Improves Dashpot Timing Device

The nitrogen impact fishing jar developed by Houston Oil Field Materials, Inc., presents a new approach to the problem of loosening tools jammed in the depths of oil wells. On impact, old style jars shake and strain derricks and pipe strings. The new Homco unit eliminates wear and tear on equipment by concentrating all its 208 ton kick inside the jar attached to the jammed tool.

Another valuable feature of the new Homco jar is regulated impact time. By means of a unique dashpot timing device containing Dow Corning 200 Fluid, the hammer blow can be delayed while the jar is moved into a new postition. By varying the quantity and viscosity of the silicone fluid, the impact time may be varied from a few seconds to half an hour.

Dow Corning 200 Fluid was selected as the dashpot oil after tests proved it to be the most heat-stable fluid available. Organic oils thin out rapidly when subjected to well temperatures and to the heat generated by successive impact blows. But Dow Corning 200 Fluid with its relatively flat viscosity-temperature slope, thins only slightly even after 10 to 15 hours' continuous operation. This change is so slight that it is more than compensated for by expansion of the metal parts and fittings. *No. 44*

Silicone products most widely used are indexed by type of application, in the 1955 Reference Guide to Dow Corning Silicone Products. A brief but comprehensive 8-page summary is given of the properties and applications. With increasing effort devoted to product improvement and cost reduction, such a reference guide to this remarkably stable group of engineering materials becomes increasingly important to design, production and maintenance engineers. *No. 45*

"What's a Silicone?" is the title of a 32 page booklet which answers that often asked question in semi-technical terms. Indexed and illustrated, this booklet has earned an international reputation as the most interesting and informative description of silicones ever published. *No. 46*

Design Edition 11

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Canada: Dow Corning Silicones Ltd., Toronto; **Great Britain:** Midland Silicones Ltd., London; **France:** St. Gobain, Paris

Versatile WESTERN GEAR Hoist

selected for new Bell anti-submarine helicopter!

When Bell Aircraft Corporation developed its new HSL-1 helicopter for Navy anti-submarine detection and rescue work, it selected Western Gear to design and manufacture the airborne hoist aboard the unique twin rotor aircraft. This Western Gear hoist lifts 800 lbs. at 50′ per minute. The hoist shown in inset above, weighing 28 lbs. and similar in design to that selected by Bell, can lift 400 lbs. at 100′ per minute, spooling more than 100′ of 3/16″ cable. By modifying the gear train it can lift up to 1600 lbs. at 25′ per minute. A level wind assures accurate spooling and the motor is equipped with radio noise filter to comply with AN specifications.

Western Gear's more than 40 years of experience supplying important components for aircraft of practically every description was a major factor in its selection by Bell to design and manufacture this vital hoist for airborne use. Knowledge obtained since 1888 enables Western Gear to provide a speedy, economical solution to any problem involving the mechanical transmission of motion or torque. Why not avail yourself of this experience to solve your problem? Western Gear engineers will be glad to offer their help and recommendations from your blueprints or specifications. Address General Offices, Western Gear, P.O. Box 182, Lynwood, California.

"The difference is reliability" ★ Since 1888

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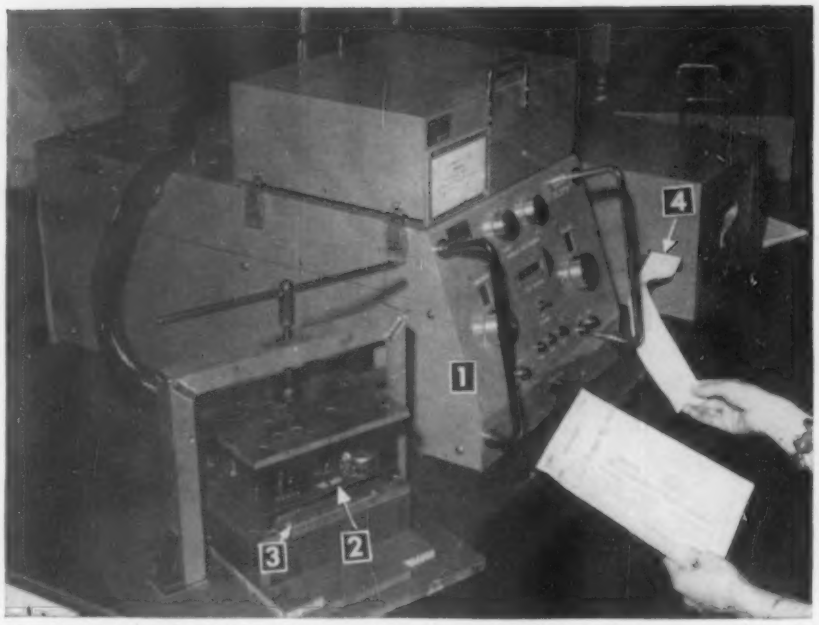
WESTERN GEAR
ENGINEERS AND MANUFACTURERS

single program head and fixture which, by means of punched tape, will be instantly changeable to accommodate a variety of printed board types.

LMEED carries its automatic test philosophy one significant step beyond that of testing merely the individual sub-assemblies which make up a more complex equipment. GE has developed a unit which makes operational checks on completed equipment automatically, taking its operating instructions from punched tape.

The tape sets up various conditions of input, output, or load, then measures pertinent voltages, currents, etc., and prints out its findings. These too are accepted by Government inspectors. The LMEED operational tester (see photo, p. 72) has been in use for more than a year, Statt says.

When used on one moderately complex LMEED equipment, the operational checker runs through 57 continuity checks, nine network checks, and 20 circuit parameter checks in less than 15 minutes, including several minutes of time delay required for circuit value stabilization. The same procedure used to take 80 minutes with conventional manual techniques. Added advantage is that the printed results of all test measurements speed troubleshooting when a faulty equipment is encountered.



AUTOMATIC TESTER (1) speeds inspection of sub-assemblies (2), shown mounted in test fixture (3). Printed record (4) pinpoints faulty circuit or component.

Prior to making each quantitative measurement, the machine automatically checks itself against master standards. At present, the unit can not be used for tests which involve an examination of waveshape—an important item in certain types of equipment. However, LMEED engineers are investigating techniques which they hope will enable them to automatize this important phase of operational testing.

About two years ago, in line with GE's vast decentralization program, the company split up its Electronics

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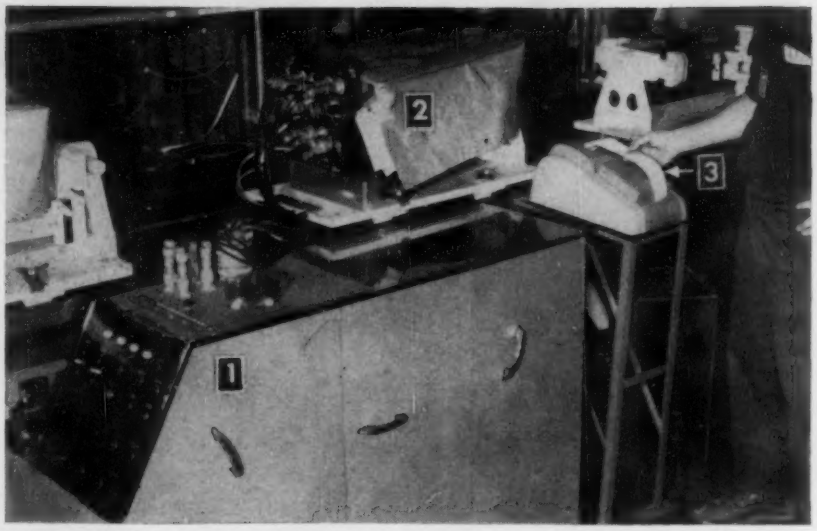

GE-DEVELOPED automatic functional tester (1) makes quantitative measurements of operational characteristics of complete pieces of equipment (2), and prints out its findings (3). Device gets operating instructions from punched tape.

Division's military activities into two groups:

- **LMEED,** at Utica, develops and makes small equipment, many of them for airborne use.
- **HMEED** (Heavy Military Electronic Equipment Division), Syracuse, develops and manufactures large ground, ship, or mobile equipment, such as air defense radar.

One object of the split along these lines was to divorce the more highly competitive small equipments, which lend themselves to production-line techniques, from the manufacture of the larger equipments, which are most generally manufactured in much smaller quantities.

In some programs, such as a current one for a data link system, the two divisions take on the job jointly, with LMEED doing the airborne equipment and HMEED the ground-based. Sometimes other groups in the Electronics Division get into the act, including such facilities as the Advance Electronics Lab at Ithaca, N. Y., and the new Microwave Lab at Palo Alto, Calif.

LMEED itself employs 250-275 graduate engineers. These are roughly divided equally among four engineering sections: radar and countermeasures, special systems and devices, search radar and navigation and advanced engineering.

Approximately 60% of LMEED's output goes to the USAF, 35% to the Navy (BuAer), and the remainder to miscellaneous customers. Most of this output is destined for aircraft or missiles.

Cast free from other groups in GE's Electronics Division, with their somewhat divergent interests in large land-based equipment and radio-TV sets, LMEED has been given the freedom, and it shows the willingness, to try new approaches aimed at enabling a large firm to compete favorably with small, low-overhead rivals.

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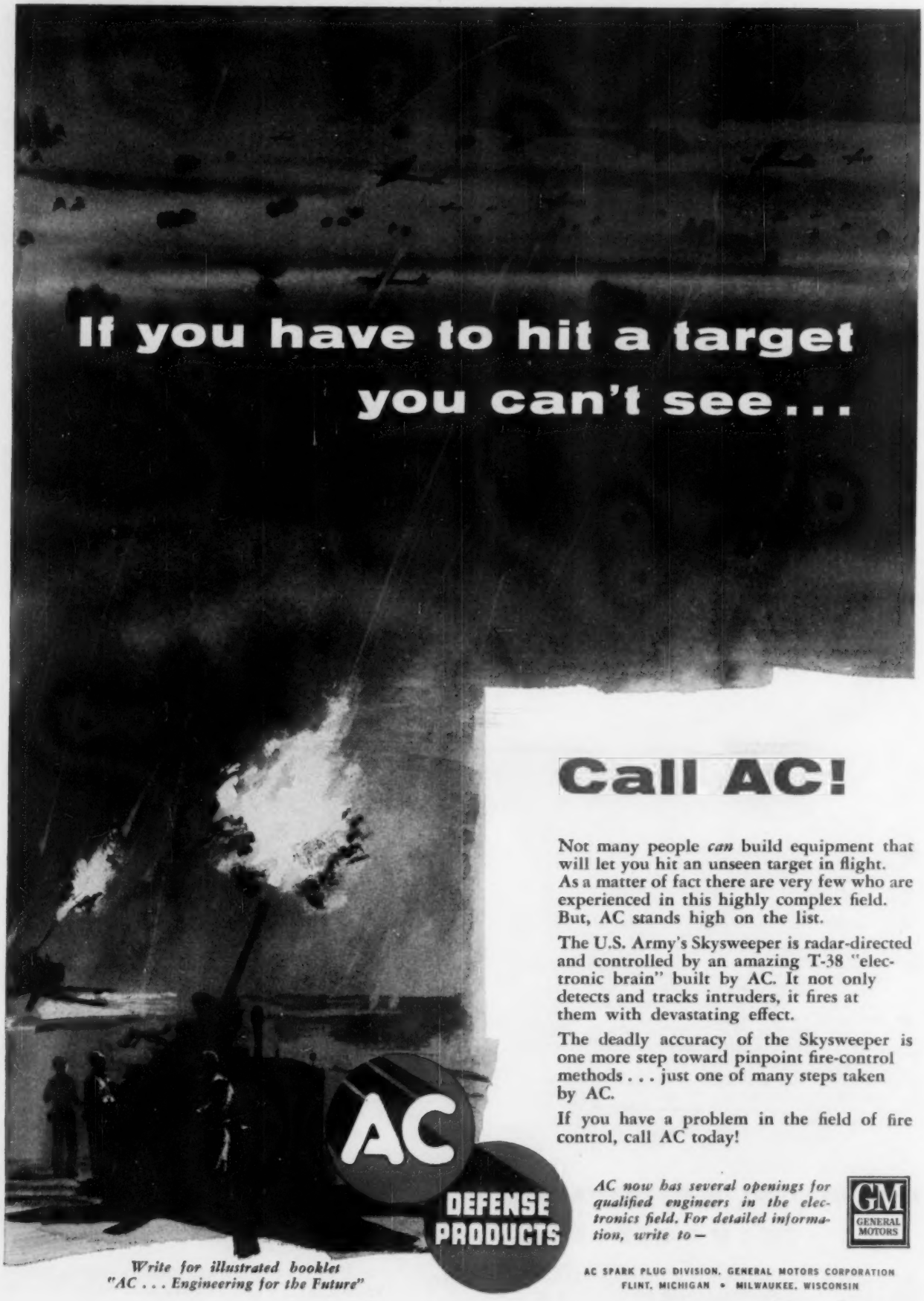

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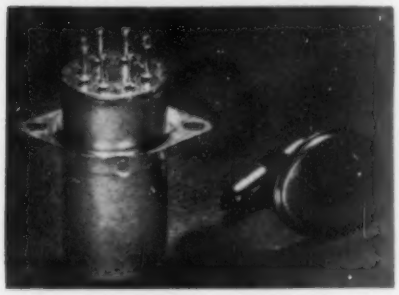
Components & Devices

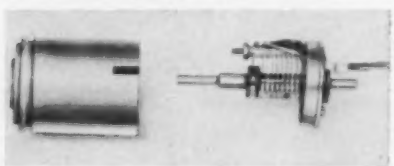
● Sub-miniature relay, measuring only 0.656 in. dia. x 1½ in. long, and weighing only 1 oz., comes in DPDT model, with contacts rated 5 amp., resistive load at 28 v. d.c. or 115 v. a.c. Unit,



which operates over ambient temperature of −65 to 125C, reportedly meets test requirements of MIL-R-6106A, and has minimum life of 100,000 operations at rated load. **Electro-Mechanical Specialties, Inc., 6819 Melrose Ave., Los Angeles 38, Calif.**

● Sub-miniature motor-generator, Type MG-3013, measuring 1 in. dia. x 2.625 in. long, and weighing 6.2 oz., puts out 1.25 volts/100 rpm. into a 100,000-ohm load. Speed is continuously variable from 200 to 8,700 rpm., with generator output reportedly linear over this range. Harmonic distortion is under 5%. Motor is a 115 v., 400 cps., 2-phase unit. Magnetic detent stops output shaft in any one of four positions within 5-deg. accuracy. **John Oster Manuf. Co., Avionic Div., 1 Main St., Racine, Wis.**

● Low-torque selector switch with low contact resistance is designed for operation at temperatures in excess of 350F. Unit with 10 input circuits and one output circuit measures less



than 1 in. dia. x 2⅜ in. long. Device can be used as a chopper up to speed of 1,500 rpm. **Electro Tee Corp., South Hackensack, N. J.**

● Transistor-magnetic amplifier, for 60-cycle servo system use, is rated at 10 watts output. Two power transistors are gated by a magnetic amplifier, giving fast response. Unit has a transistor pre-amplifier and stabilizing network. Amplifier can be operated up to 85C, weighs under 20 oz., measures 1½ in.

MALLORY·SHARON reports on

TITANIUM

MST 6Al-4V is primarily a bar and forging alloy; also has specialized sheet and plate applications.

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● The problem of elevated temperature embrittlement present with many titanium alloys has been overcome with this newest development. MST 6Al-4V (6% aluminum, 4% vanadium, balance titanium) can be used at temperatures up to 750°F with minimum creep or change of properties. It has excellent strength and stability at high temperatures, is relatively insensitive to notches, and can be hot worked over a wide range. It can be readily machined, welded, or heat treated.

Like all Mallory-Sharon alloys, MST 6Al-4V is vacuum double melted, assuring homogeneity and consistent quality. Specify it for consistent, predictable, high temperature performance. A bulletin listing complete data is yours for the asking. Write Mallory-Sharon Titanium Corporation, Dept. B-8, Niles, Ohio.

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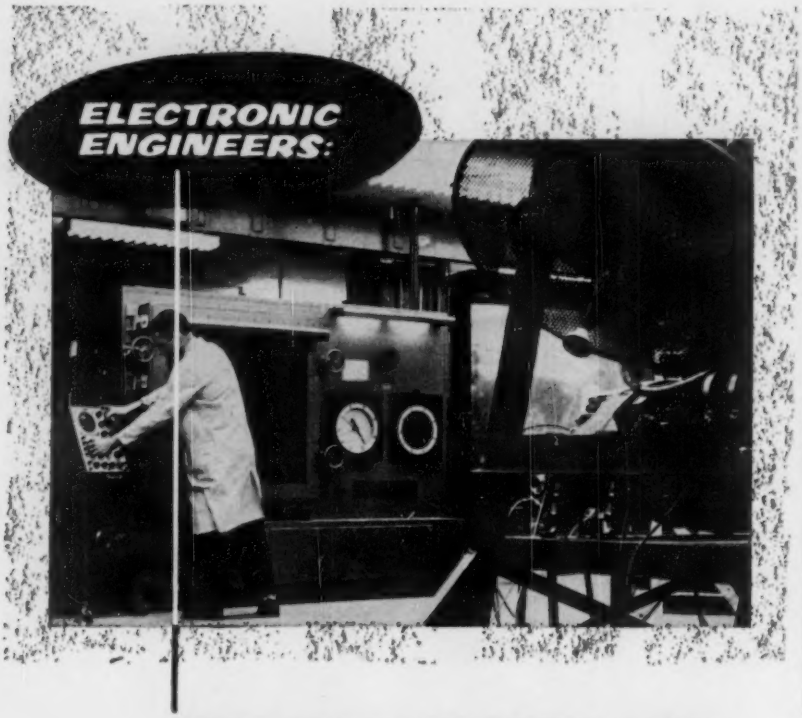

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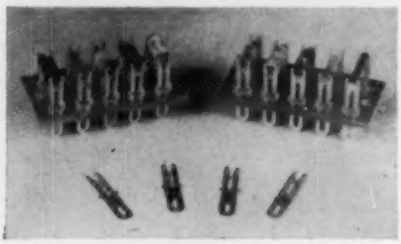
dia. x 5⅞ in. long. **Librascope, Inc., 808 Western Ave., Glendale, Calif.**

● Corrosion-resistant servo motors, a new series of low-inertia 2-phase, 6-pole, 400-cycle types, can be operated at temperatures of −55C to 163C, at altitudes up to 80,000 feet. Units are available in various speed/torque combinations and may be obtained with an integral tach generator if desired. Motors measure 2 in. dia. x 2.4 in. long. **Eclipse-Pioneer Div., Bendix Aviation Corp., Teterboro, N. J.**

● Solderless diode clip, reportedly designed to hold 90% of all standard diodes, comes in three styles: push-in, stake-in, and eyelet rivet. Units are made from beryllium copper base,



plated with gold, silver, or electro-tin. **Metal Products Engineering, Inc., 4000 Long Beach Ave., Los Angeles 58.**

Transducers

● High temperature pressure and acceleration pick-ups can be operated at temperatures as high as 2,200F. Model 2502, for measuring dynamic pressure, reportedly has flat frequency response from 2 to 5,000 cps., and is available in several pressure ranges up to 5,000 psi. Output is 40 mv./psi. in the lower range. Model 2205 accelerometer covers range from 0 to 1,000G, and has flat frequency response between 2 and 4,000 cps. Output is at least 10 mv./G. Provision is made for cooling transducer element with fluid or air in both units. **Endevco Corp., 180 East California St., Pasadena 1, Calif.**

Laboratory Equipment

● Three-phase power supply, Model 500, supplies 500 va. of 300 to 500-cps. power into a delta-connected load. Output voltage can be varied from 103 to 126, with 1% regulation from no-load to full load. Maximum distortion is quoted at less than 7% under full load. **Resdel Engineering Corp., 330 So. Fair Oaks Ave., Pasadena, Calif.**

● Deckabridge, Model 210, a wheatstone bridge repackaged and restyled to use manufacturer's novel concentric dials, provides single-line readout to four places for resistances of 0 to 12 megohms, in seven different resistance

DE HAVILLAND
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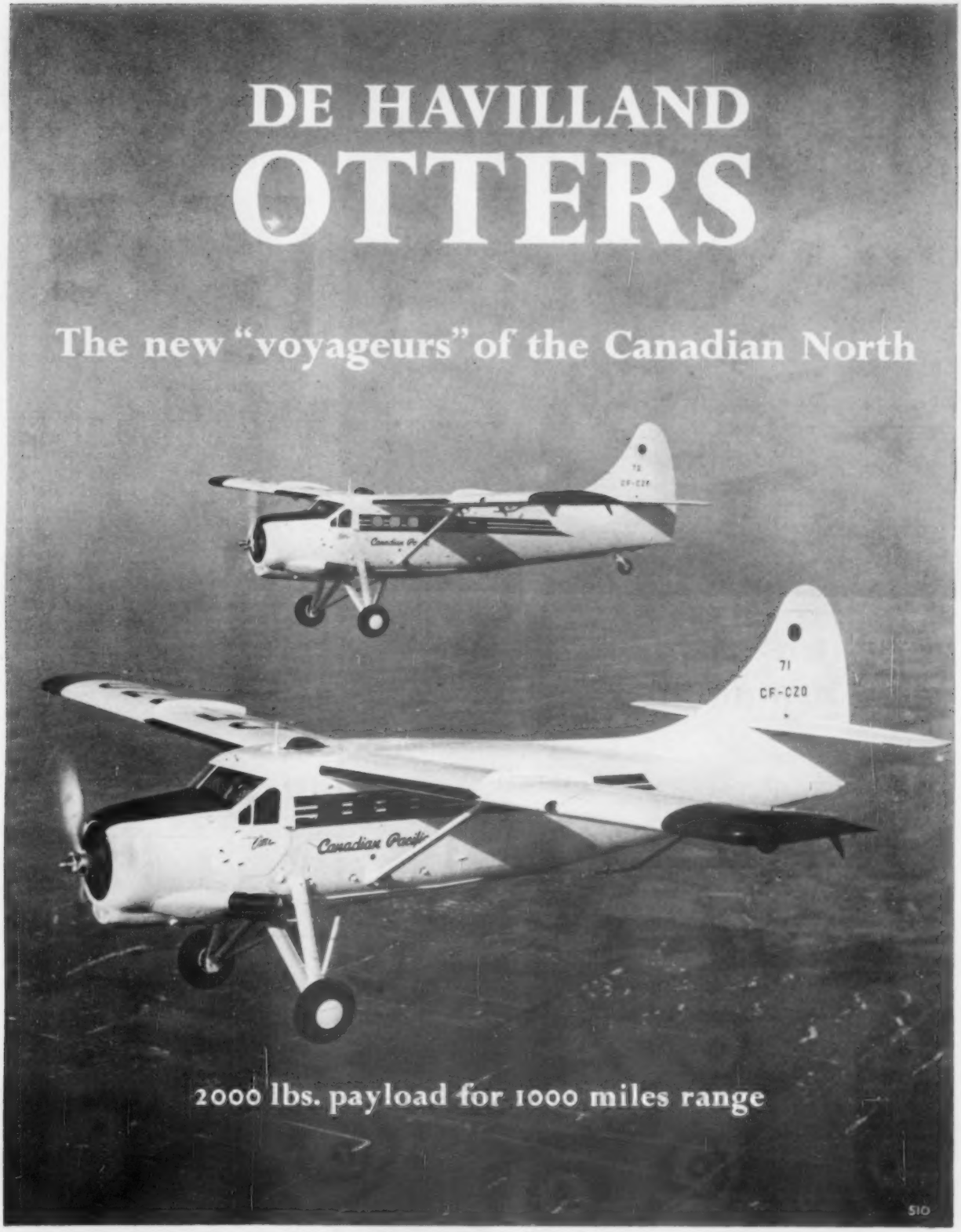

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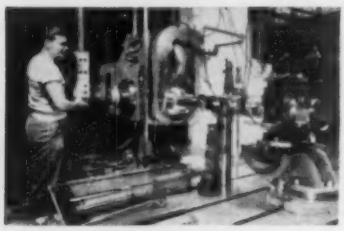

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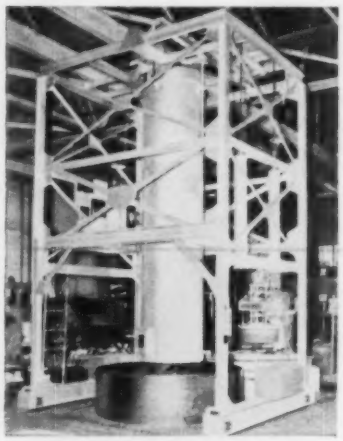
Your welding assemblies can also be given almost any machining or finishing that you require when they are contract-welded at Cleveland Pneumatic. Our modern machine shops include all types of turning lathes and machines, from giants that can turn columns 25 inches in diameter and 17 feet long to micro-precise thread grinders capable of producing any aircraft-quality threads on parts up to 13-inch-diameter.



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A large and experienced heat-treating department can give your contract-welded parts the type of heat treatment that is required. Giant heat-treating furnaces and quench tanks 18 feet deep can handle alloy-steel parts up to 15 feet in length.

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ranges. Resistance can be read to within 0.001 ohm on lowest scale. Maximum measurement error is 0.1% manufacturer says. **Electro-Measurements, Inc., 4312 S.E. Stark St., Portland 15, Ore.**

● Regulated power supply, Model 702A, provides up to 200 ma. at 0 to 600 volts, continuously variable, with regulation of ¼% or better and ripple less than 10 mv., peak to peak. Variable negative output of 0 to 150 volts is provided for bias, as well as 6.3 v. at 8 amp. for filament supply. **Shasta Div., Beckman Instruments, Inc., P.O. Box 296, Richmond, Calif.**

Engineering Aids

● MechaKit, for use by servomechanisms designers, contains a variety of gears, shafts, worm drives, supports, calibrated dials, and other useful build-

ing blocks which enable speedy construction of laboratory models. MechaKit comes in three different sizes. **Servomechanisms Inc., 625 Main St., Westbury, L. I., N. Y.**

● Pulse transformer kit. Cat. 100Z1, contains five different lab-type pulse transformers, with primary inductance values ranging from 0.5 mh. to 50 mh., and turns ratios as high as 8:1. Engineering Bulletin 502 gives details on manufacturer's pulse transformers. **Sprague Electric Co., 327 Marshall St., North Adams, Mass.**

FILTER CENTER

► **Electronics Output Increases**—The electronics industry is expected to turn out $6.2 billion in military and consumer products this year, compared to $5.8 billion last year, according to a mid-year survey by the Commerce Dept.

► **New Test Facilities**—Complete environmental test facilities for checking avionic components and devices to MIL specs are available at American Electronic Laboratories, Inc., 641 Arch St., Philadelphia 6, Pa. Four-page brochure outlining facilities is available.

UNDER WAY

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Fort Worth in the Great Southwest has an abundance of sunshine and dry, fresh air conducive to outdoor living and recreation. Within a few minutes drive of Fort Worth are seven large lakes which provide ample facilities for fishing and other water sports.

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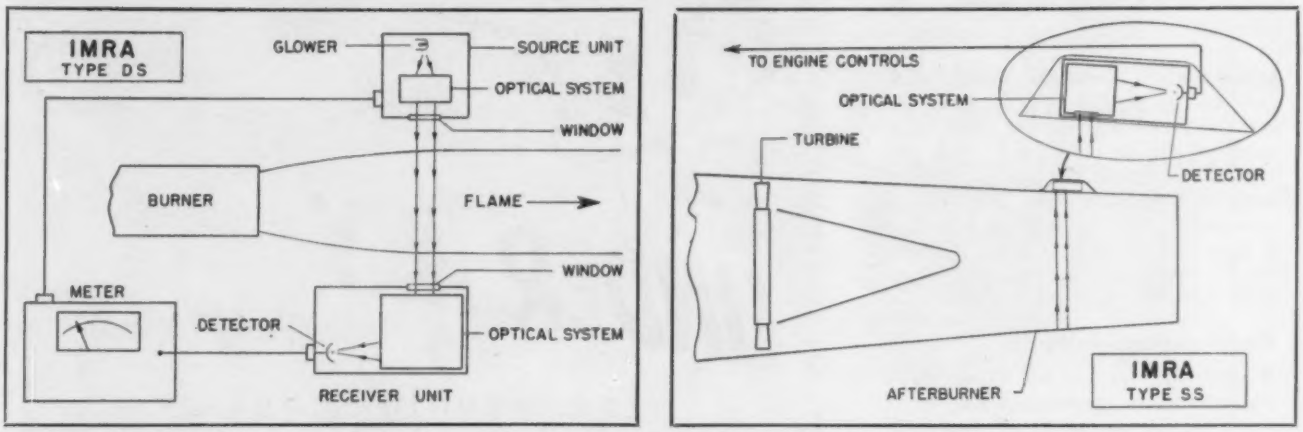


IMRA PYROMETERS: Left, a double-sided pyrometer attached to rocket exhaust. At right, single-sided pyrometer on afterburner.

Pyrometer Aids Jet Engine Control

The development of a compact infrared pyrometer to measure accurately, and almost instantaneously, the temperature of flames and hot gases in the 1,000-7,000F. range was announced recently by the Warner & Swasey Research Corp., in New York. Plans already are underway for the construction of a ground unit for turbojet testing.

The temperature cycle of a heat engine defines its thermal efficiency. Therefore, an instrument that measures temperature accurately and quickly and can emit a usable impulse, can be used as a basic engine control.

The IMRA Pyrometer measures hot gas radiation and translates them into temperature readings with a time lag measured in milliseconds and accuracy of 1%.

Known as an IMRA (Infrared Monochromatic Radiation) Pyrometer, the instrument has practically no upper temperature limit except that at which the gases dissociate and will be—its designers hope—compact enough to be airborne. W&SR scientists say the pyrometer will handle the job of basic engine control faster and more accurately than the thermocouples which have been in use since the inception of jet engines.

Reaction time of the thermocouples is slow, and the temperature reading has to be sent to the pilot who then regulates his engine accordingly. W&SR hopes the IMRA Pyrometer, developed after eight years of research, will be capable of controlling a jet engine directly, bypassing the pilot entirely.

Thus far, two types—single-sided and double-sided—have been developed, both based on the principle that hot gases emit radiation in specific bands in the invisible, infrared region of the spectrum. This radiation is a characteristic of the hot gas temperature.

Single-Sided IMRA

The single-sided IMRA is the type W&SR plans to develop into control devices for hot-gas engines such as turbojets. Use of temperature as a control source becomes all-important when dealing with engine types or auxiliary power systems which have no other control parameters.

Among these are afterburners, ramjets and rockets.

Here is the theory behind single-sided IMRA: Radiation of a hot gas varies with three factors—type of gas, quantity of gas and gas temperature.

Since all jet engines presumably will burn a hydrocarbon base fuel, the first variable—the type of gas—is known and can be compensated for.

Next variable to eliminate is quantity of the gas. It is particularly in this phase of IMRA's development that W&SR scientists did much original research and were, their company says, the first to establish the possibility of predetermining the absorption factor of gases in order to correct for the effect of gas quantity.

Since the hot gas path in a jet engine is fixed and the absorption factor can be predetermined, these factors can be incorporated in the instrument's calibration and eliminated as a variable. Thus, two of the three variables have been canceled out and the instrument will indicate only the third variable—temperature.

Research leading to solving the problem of predetermining the absorption factor was complicated by a third dimension. The absorption factor used in IMRA is equivalent to the emissivity correction well known in conventional pyrometry.

The big problem that W&SR scientists had to lick was that of dealing with emissivity in depth—the round, hot gas stream of a jet engine exhaust.

IMRA Operation

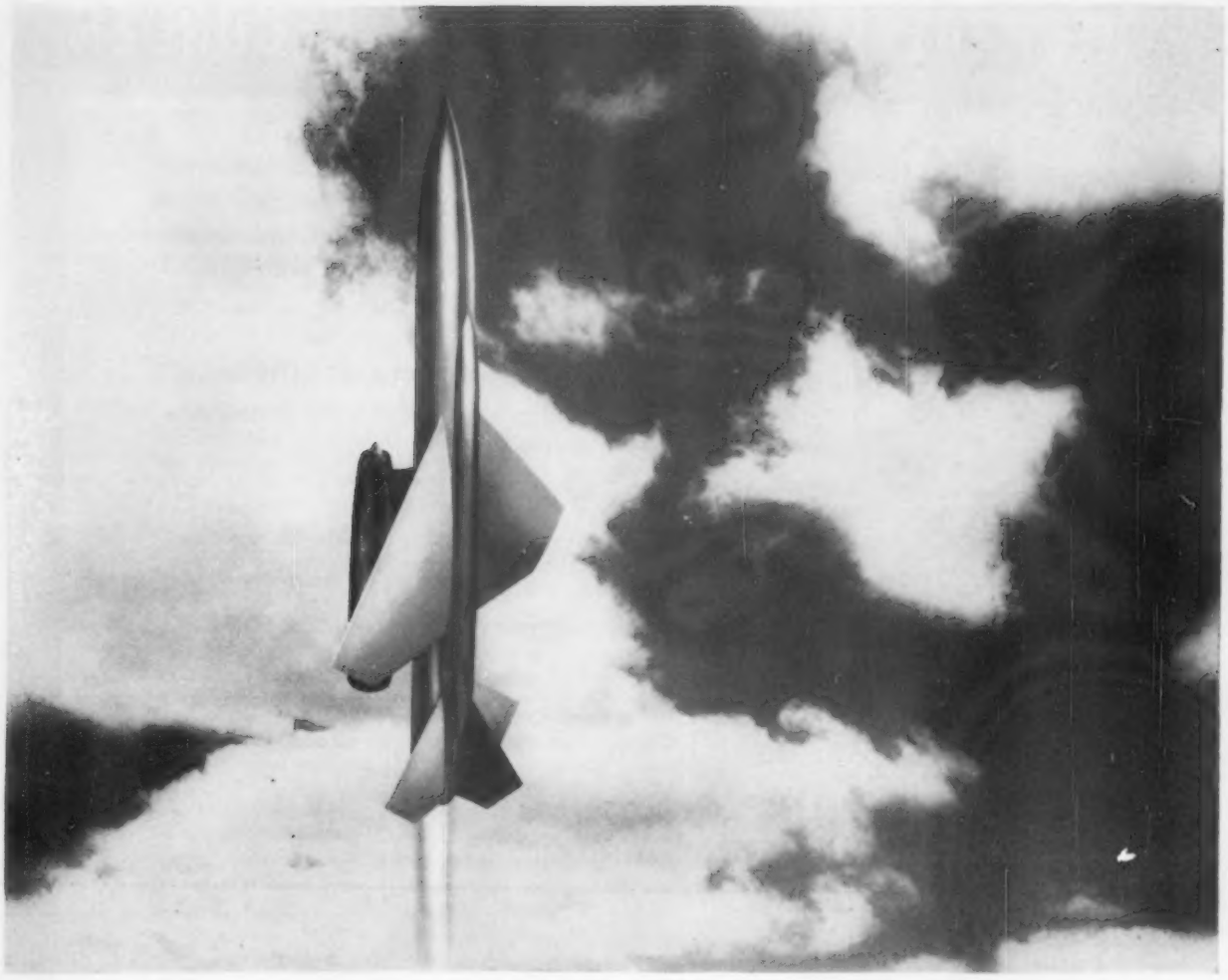
A single unit is mounted at or near the flame or hot gas stream and the only requirement is a small aperture through which gas radiation can reach the instrument. The unit can be mounted directly to the outside of a tail pipe or even a combustion chamber. If, for such reasons as excessive heat or space considerations, the instrument must be remotely mounted, this can be done and radiation directed to it with a mirror.

Invisible, infrared radiation from flame or hot gas is collected in the instrument's receiver unit by a monochromator, a prismatic device which splits gas radiation into its spectral components. A narrow region of this spectrum is selected by a slit which allows only this small part of the spectrum's radiation to impinge upon a radiation-sensing element. The element then emits a signal which is electronically amplified and converted into a temperature reading.

IMRA Advantages

R. Tourin, W&SR's chief physicist, cites these several advantages of the IMRA Pyrometer:

• **No flow interference.** The IMRA Pyrometer, being outside the gas



Boeing engineers have a date with the future

Guided missiles like this Boeing Bomarc IM-99 are increasingly important in America's defense planning. Many kinds of engineers—electrical, mechanical, civil and aeronautical—play vital roles in developing it. The knowledge they are gaining will be priceless in producing the hypersonic vehicles and guided missiles of the future. These men explore the frontiers of engineering knowledge in rocket and nuclear propulsion, in extremes of vibration, temperature and pressure and in many other fields.

Boeing engineers are members of aviation's top creative team. The aircraft they help develop will maintain the leadership and prestige established by the Boeing B-47, the present "backbone" of Strategic Air Command . . . the B-52, our giant new global bomber . . . the Bomarc IM-99 . . . and, most recently, the KC-135, the first jet tanker-transport.

At Boeing, engineers' professional achievements are recognized by regular merit reviews and in other ways. The Boeing policy is to promote from within the organization. And Boeing is known as an "engineers' company." One out of every seven employees is an engineer! Among top management, the proportion is even higher.

Equipment at Boeing is superb: the latest electronic computers, a chamber that simulates altitudes up to 100,000 feet, splendidly equipped laboratories, and the new multi-million-dollar Flight Test Center. The world's most versatile privately owned wind tunnel, at Boeing, is soon to be supplemented by a new tunnel capable of velocities up to Mach 4.

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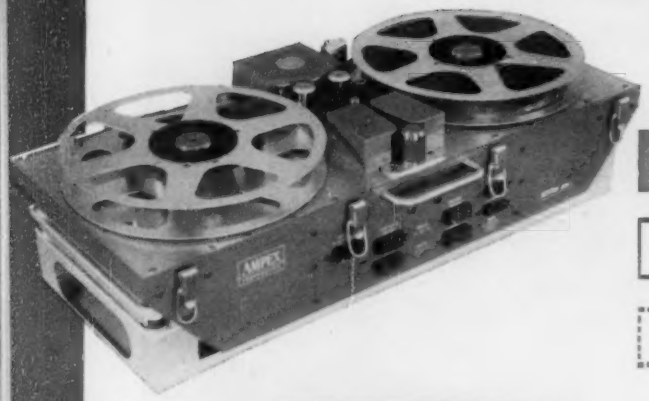
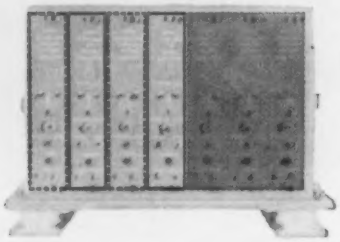


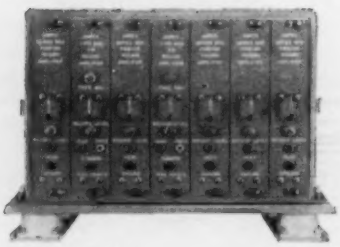
The Ampex 800 can provide from 1 to 28 data channels. By interchangeable amplifier units, each one can be adapted to any one of three basic magnetic recording techniques:

Direct recording — 300 to 35,000-cycle response for a wide-band data or multiple recording of RDB subcarriers.

FM-carrier type recording — D.C. to 5000 cycles and high instantaneous accuracy suitable for shock and vibration data.

Pulse-width modulation recording — Up to 30 instrument readings commutated on to each tape track; frequency response 0 to 5 cycles/sec.





Combinations of these recording techniques can be provided to satisfy practically any flight test requirement by simple insertion of the proper plug-in amplifiers. Separate channels can be assigned to measurements requiring wide-band response or high transient accuracy. By using pulse-width techniques, many relatively steady instrument readings can be commutated on to a single channel. All will have a common time base.

WITHSTANDS THE RIGORS OF HIGH ALTITUDE FLIGHT

The Ampex 800 will perform within specifications under vibrational forces as high as 10G — operates over a temperature range from —65° F. to +130° F. — is unaffected by altitudes to 50,000 feet — and withstands a relative humidity of 100% up to 122° F. The Ampex 800 is light in weight. It operates on 27.5 volts D.C. and 115 volt, 400 cycle, A.C. All operating functions can be remotely controlled.

RETAINS WIDELY ESTABLISHED RECORDER STANDARDS

The majority of all magnetic recorders now in instrumentation use are Ampex machines. Their recording characteristics, tape speeds, track widths and other parameters have become a standard in aircraft and missile testing. The Ampex 800 retains these standards while greatly extending the environmental and mechanical conditions under which accurate test data can be gathered.

Performance specifications, descriptions and explanations have necessarily been limited by the space on this page. A full description and detailed specifications on the Ampex 800 are available by writing Dept. UU-2243

First in Magnetic Tape Instrumentation

BRANCH OFFICES: New York; Chicago; Atlanta; San Francisco; Dayton; College Park, Maryland (Washington D.C. area)

DISTRIBUTORS: Radio Shack, Boston, Bing Crosby Enterprises, Los Angeles, Southwestern Engineering & Equipment, Dallas and Houston; Canadian General Electric Company, Canada

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stream, does not interfere with flow as do thermocouple probes which protrude into the gas path. Nor is the instrument subjected to the severely deteriorating effects of very hot, high speed gases.

• **No use limit.** Instrument is not limited by the hottest gas temperatures obtainable.

• **No multiplicity.** The IMRA device, receiving radiation throughout the width of the gas stream, averages the temperature. One unit does the work which normally would require several thermocouples since each probe senses the gas temperature at its location only.

• **Short delay.** Response of a few milliseconds is obtainable with the IMRA device as compared to one or more seconds response time for thermocouples.

• **One variable.** Only Variables present in hot gas streams, such as velocity, mass flow and turbulence, do not influence the IMRA unit as they do thermocouples.

• **No corrections.** IMRA does not require corrections, often elaborate, to take care of such factors as radiation losses, which affect thermocouples.

Here is how M. Grossman, chief engineer, delineated IMRA's final benefit: "Intensity of radiation varies with the temperature of the gas in a well-defined manner. For a moderate change in temperature, you have a large variation in radiation; this makes the IMRA Pyrometer inherently sensitive. Moreover, the higher the temperature being measured, the greater the variation in radiation. Therefore, the instrument becomes progressively more sensitive as temperature rises."

Double-Sided IMRA

W&SR developed the double-sided IMRA Pyrometer before the single-sided unit. The former has inherent deficiencies as a potential airborne instrument because of its size, weight and relative complexity.

But since the double-sided IMRA filled a decided need as a laboratory instrument for flame and hot gas measurement, W&SR developed the device to the point where it is now available as a custom-built instrument.

IMRA Status

The company says it has solved the theoretical and practical problems of manufacturing double-sided IMRAs and is prepared to go ahead as orders are received.

W. S. Tandler, company president, said research and development of the single-sided IMRA on a laboratory scale has been completed. He now wants to integrate the instrument with a jet engine to solve such remaining prob

(See you at the Wescon Show, Booth 1417-18)

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lems as how to mount the unit, its needed configuration and size and how it can be tied into the engine's control system. Power requirements are 50 watts a. c.

W&SR is about to establish a program to build a small unit, first for ground test engine work only. Next step will be to further miniaturize the unit, work out any "bugs" and produce an instrument capable of working reliably as an airborne device, which is Tandler's ultimate goal for the single-sided IMRA.

Twenty Years Ago

Tandler started his business twenty years ago doing research and development in the field of electrical and electronic controls for machine tools and automatic measuring instruments. His organization, then called Industrial Scientific Co., was located at the same address as today's much expanded organization, 34 W. 33rd St., New York.

Business gradually grew until, in 1954, he made an arrangement with the Warner & Swasey Co. and formed the current Warner & Swasey Research Corp. as a partially-owned subsidiary of the parent company. Today the organization is doing research and development in the fields of instrumentation and controls for several companies, including Warner & Swasey.

At the same time, Tandler is pushing his IMRA instruments. He is also producing probographs, a bleed gage being used by such jet engine manufacturers as Ford Aircraft Engine Division, Chicago.

OFF THE LINE

Babb Co.'s instrument division has signed a contract to overhaul all instruments for Bonanza Airlines in its new plant at Sky Harbor Airport, Phoenix.

Lockheed Aircraft Service—International has started work on two new contracts for the Aviation Supply Office, U. S. Navy. Company is overhauling various components of cabin-supercharger driveshaft-disconnect assemblies for an undisclosed number of R7V, WV-1 and WV-2 Super Constellation aircraft.

All commercial airlines in the U. S. are now using nylon-reinforced tires, according to du Pont. First commercial nylon tire installation was made in mid-1944.

United Air Lines is adding a two-story hangar and new flight kitchen to its Seattle-Tacoma Airport facilities at a cost of over $1 million.

Official United States Navy Photo

engineers for ARRESTING *gear and catapult developments*

Here is an opportunity to participate in a vital All American program—the design and development of arresting gear and catapults. At All American you will work in the finest test facility in the country for this specialized work.

This research program is typical of the engineering services available at AAE. Yet it is only one phase of All American's far ranging researches. Currently on the boards or in production are projects which include several types of winches for aircraft and airship use, air pick-up equipment, seat ejection trainers, universal landing gear and portable mooring masts.

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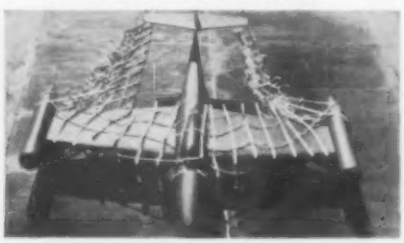
This Arresting Gear for runway use absorbs energy by drawing a steel ribbon through a stationary brake block.



Dynamic scale model airplanes are used by AAE in the design and development of emergency overrun barriers.

This jet-propelled test car was designed by AAE for the development of arresting gear and barriers.

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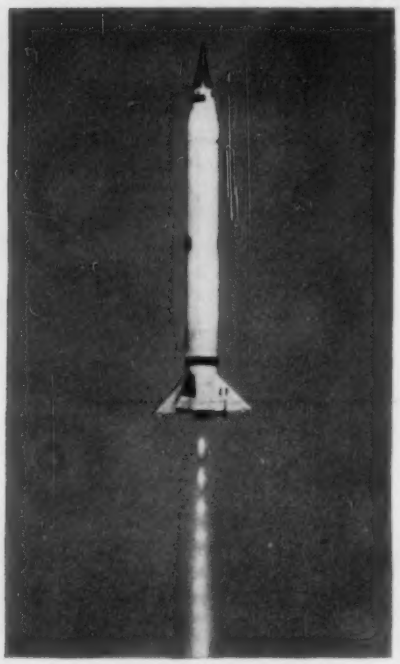
Problems new to man and unique with this new concept of power are constantly being solved by RMI's scientists, engineers, and skilled production craftsmen... opening new horizons in physics, chemistry, aerodynamics, and related fields. Today, with recently expanded research and production facilities at Denville, N. J., RMI is bringing super transportation years closer.



RMI's continual design progress is reflected in the ever-advancing performance of the Viking missile (shown left). Powered by a 20,000-pound-thrust RMI rocket engine, Viking 11 has broken the world's record for single stage missiles by climbing 158 miles into space and reaching a speed of over 4,300 miles per hour.

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WHAT'S NEW

Publications Received:

• **Commercial Air Transportation,** Fourth Edition—by John H. Frederick—Pub. by Richard D. Irwin, Inc., Homewood, Ill. $6.00; 547 pp. A survey of commercial air transportation in the U. S.

• **Hydraulic Operation and Control of Machines**—by Ian McNeil—Pub. by Ronald Press Co., 15 East 26th St., N. Y. 10, N. Y. $7.50; 319 pp. Problems encountered in operation of hydraulic equipment.

• **Flight Instructor,** 11th revised edition—by Charles A. Zweng—Pub. by Pan-American Navigation Service, 12021 Ventura Blvd., North Hollywood, Calif. $5.00; 259 pp. Covers standard methods of flight instruction.

• **The Aeroplane Directory,** 1955 Edition—compiled by the Staff of The Aeroplane—Pub. by Temple Press Ltd., Bowling Green Lane, London, E.C.1; 21s net, $2.94; 582 pp. Guide to aviation throughout the British Commonwealth.

• **National Fire Protection Association Bulletins:** Aircraft Rescue and Fire Fighting Equipment for Airports, No. 403; 50¢; Aircraft Rescue and Fire Fighting, Techniques for Municipal and Rural Fire Departments, No. 406, 35¢; Fueling Aircraft on the Ground, No. 407; 50¢ Aircraft Hand Fire Extinguishers, No. 408; 25¢; "Inerting" Aircraft Fuel Tanks, No. 405-TR; 25¢; Aircraft Fuel Servicing Vehicles, No. 407A-T; 25¢. Available from National Fire Protection Assn., International, 60 Batterymarch St., Boston 10, Mass. There are discounts for quantities.

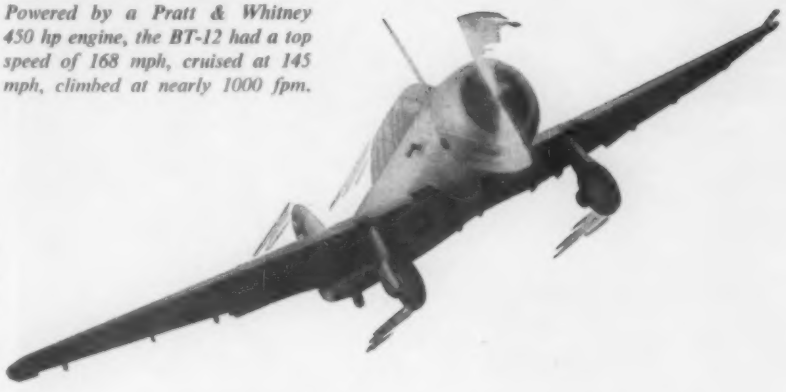
Telling the Market

To provide firing safety function between **electrical primers** and a **primacord firing train,** Model 173-1 lanyard-armed, electrically-fired initiator and Model 175-1 electrically-armed, electrically-fired, telemetered initiator, Leaflet Form DS1-555, Beckman & Whitley, Inc., 906 E. San Carlos Ave., San Carlos, Calif. . . . **Aircomatic inert-gas-shielded metalarc welded equipment,** catalog, Air Reduction Sales Co., 60 East 42 St., New York 17, N. Y.

World Plastics Fair and Trade Exposition, Oct. 5-9, exhibits catalog, National Guard Armory, 700 Exposition Blvd., Los Angeles 7, Calif. . . . **Optical Tooling for Aircraft,** catalog, Farrand Optical Co., Inc., Bronx Blvd. & E. 238 St., New York 70, N. Y. . . . **Adhesive Bonding,** manual, Dept. "P", Rubber & Asbestos Corp., 225 Belleville Ave., Bloomfield, N. J.

How LP gas power, provides operational and maintenance savings on fork lift trucks, brochure, Towmotor Corp.,

Stainless Steel BT-12 Basic Trainer. Powered by a Pratt & Whitney 450 hp engine, the BT-12 had a top speed of 168 mph, cruised at 145 mph, climbed at nearly 1000 fpm.



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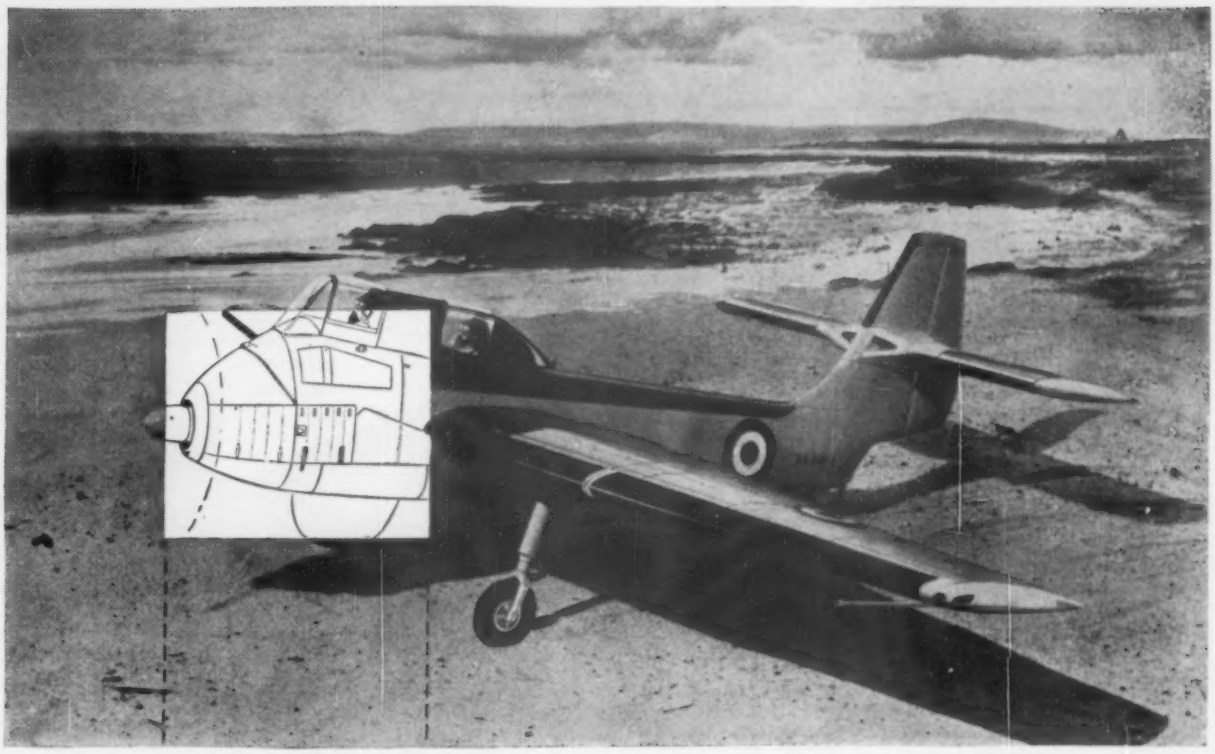
Walking-type-Hi-Lift TTF-20 pallet truck, Bulletin 551-2, Barrett-Cravens Co., 628 Dundee Rd., Northbrook, Ill. . . . **Direct Angle and circle measuring units,** data chart, Engis Equipment Co., 431 S. Dearborn St., Chicago 5, Ill. . . . **"Design File" for rubber-phenolics,** CDC-237A, General Electric Co., Pittsfield, Mass.

Business plane overhaul and service facilities, brochure, Southwest Airmotive Co., Love Field, Dallas, Tex. . . . Background data on the **Advisory Group on Electron Tubes,** an agency of the Assistant Secretary of Defense for Research and Development, booklet, New York University Secretariat, Advisory Group on Electron Tubes, 346 Broadway, New York 13, N. Y. . . . **Design Manual for High-Strength Steels,** U. S. Steel Corp., 525 William Penn Pl., Pittsburgh, Pa.

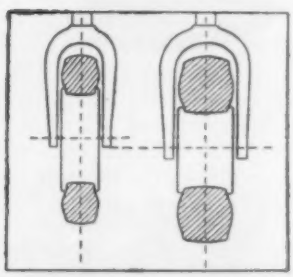
Canadian Jets for NATO

European-bound F-86 Sabres roar over the RCAF Station at St. Hubert's, Quebec. Built by Canadair, they will join other Canadian squadrons serving with NATO.

Sand strip – *Seamew* base

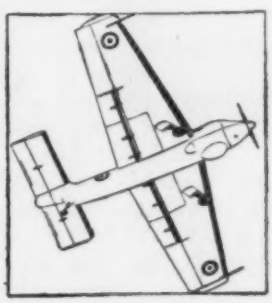


Simplicity of design ensures simplicity of maintenance—and economy in initial cost and in use of spares and manpower. Removable panels make components easily accessible.



The wheels of the Seamew can be swiftly changed, with differing sizes of tyre to suit the surfaces from which it operates.

Seamew—a tough, economical, all-weather submarine hunter. Airborne in a short distance from any rapidly constructed airstrip—or even a stretch of beach—the Seamew can conduct a maritime search with up-to-date radar equipment and use a variety of weapons to effect a kill. Its high manoeuvrability, low stalling speed and fixed shock-absorbing undercarriage enable the Seamew to land back safely after operating in weather conditions impossible for other anti-submarine aircraft.



Generous flap surfaces contribute to the very low stalling and landing speeds. The Seamew requires the minimum length of runway on emergency airstrip or escort carrier deck.

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to be strengthened with SEAMEWS

—British Defence White Paper

Design commissioned April 1952.

First flight August 1953.

Now in production for the Royal Air Force and the Royal Navy.

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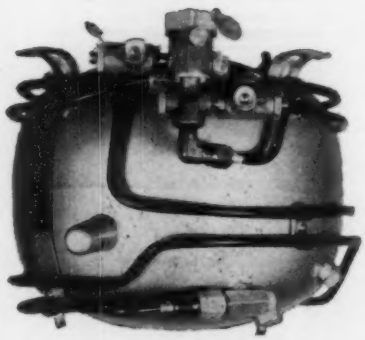

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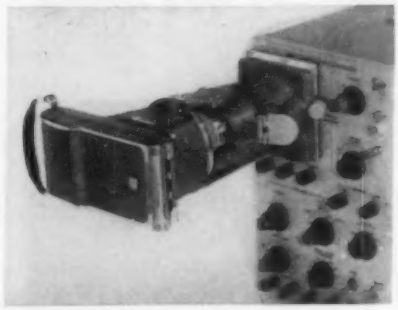


Compact Oscilloscope Camera

Compact oscilloscope camera provides accurate, single-frame photographic records of CRT phenomena 60 sec. after exposure of the scope image.

Recordoscope 1414, based on an adaptation of a small Polaroid fast-print magazine, mounts easily on standard three or five-inch scope. Swing-away hood and mounting plate are included in packaged accessory group.

Aremac 1414 can record three exposures on one 2¼-in. by 2⅞-in. print.

Aremac Associates, 50 S. San Gabriel Blvd., Pasadena, Calif.

G&L $1 Million Tool Exhibit

Giddings & Lewis $1 million exhibit at the National Machine Tool Builders Association show, International Amphitheatre Chicago, Sept. 6-17th, will be highlighted by these new machines:

• **Hypro extra-heavy double housing planer** will be shown working cast iron and steel at 400 ft. per minute tool speed. Dual saddle and slide controls, power cross feed to side heads, electric rail clamp and extra high pneumatic tool lifters are featured. High horsepower adjustable voltage motor drive has a table speed range from 25 to 400 ft. per minute. Hydraulic table top controls maximum table movement.

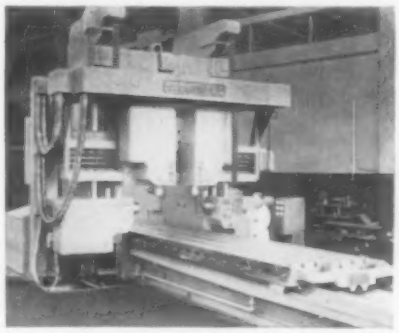
• **460 FUAR single-spindled horizontal** borer, driller and miller has six-inch diameter spindle and 30-hp. a.c. motor on headstock for direct drive to spindle. Spindle has 32 speeds from 3 to 800 rpm. Telescopic directional reading verniers are on headstock, runway and machine underarm. All movements are powered; special power hoist handles heavy tools.

• **570 FUAR floor-type, high-power precision horizontal borer, driller and miller** uses seven-inch main spindle and a built-in underarm support under the headstock which increases the machine's accessory tool capacity. Operator's elevator permits him to select best working position.

• **42-inch vertical turret lathe** with directional control of feed and traverse movements and "joystick" instant powered remote control shift. Each head has independent feed and traverse. Swiveling turret and ram heads are counterbalanced for easy motion. A 50-hp. motor drive and one-half ton pump for cooling at high speeds and heavy loads are also featured.

• **Eight-foot heavy-duty vertical boring and turning mill** has box-type construction housings and extra-heavy bed and table unit to hold 55 tons. Speed-range covers (0.7-60-rpm.). Constant surface speed and chip-thickness control attachments are included. 75 hp. adjustable voltage drive provides wide range of table speeds.

• **10-in. quill Hypro planer-miller** has four heads, each with a 50 hp. water-cooled motor and 24 spindle speeds from 9 to 500 rpm. heavy-section table is driven by a d.c. motor through a



combination cone worm and wheel and double spur gear on rack arrangement. Operator can position heads by remote control. Rigid clamp binding of sliding parts gives solid support from cutter to machine frame.

• **"Lubri-cool" refrigerating system** is said to cushion variations in lubrication temperature to conform with ambient or operating temperatures.

• **300 RT horizontal borer, driller and miller** features 30-in.x36-in. revolving work table. Spindle speeds range from 7 to 1,600 rpm.

Giddings & Lewis Machine Tool Co., Fond du Lac, Wis.

Machine Speeds F-100 Wiring

Automatic aircraft wire preparation machine produces aircraft wiring in one operation and requires only one operator. The unit, used at North American Aviation's Los Angeles plant, was de-

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New! A Practical Audio Amplifier for cockpit & cabin speakers at a practical price. Weighs only 2¾ lbs. less shockmount. Call, write or wire today. Immediate delivery.

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Low Volt. Input: 28 V.D.C. @ .5 amp or 14 V.D.C. @ 1 amp
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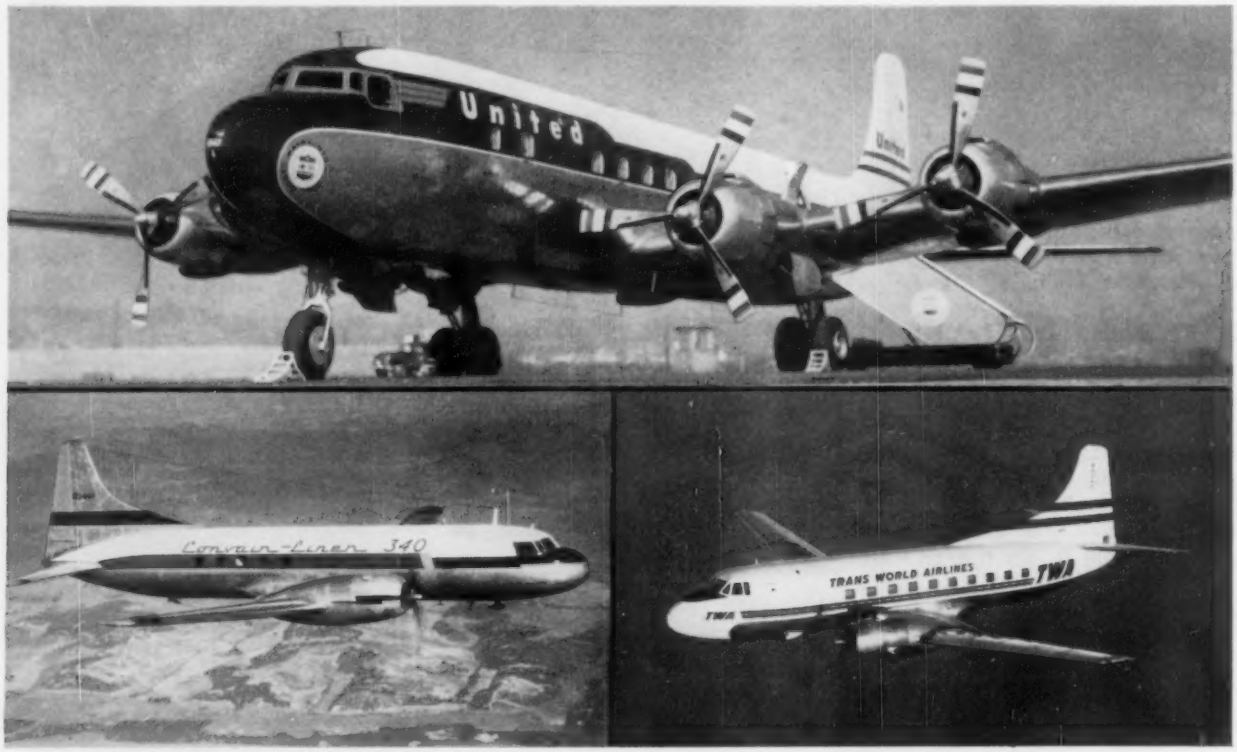
THE FREE WORLD FLIES

IF ANY ONE aircraft engine can be called the standard of commercial aviation in the free world, it is the dependable Double Wasp built by Pratt & Whitney Aircraft.

This 18-cylinder power plant, designated the R-2800, is installed in more than 1000 of the free world's modern, commercial airliners now in use or on order. Seventy-two airlines, and many large business fleets, are equipped with aircraft powered by Double Wasps. Included among these are all the models of the four-engined Douglas DC-6, as well as all twin-engined Convair and Martin airliners.

Like the earliest Wasp engine of 1925, and the famous engines of succeeding years, the 2500 hp R-2800 is outstanding for its power, its efficiency, and its clean-running dependability.

These are the power plant qualities that make Pratt & Whitney Aircraft piston engines first choice for nearly 80 per cent of all commercial aircraft. They are the qualities that have helped create and maintain an unrivaled position for America's commercial aviation.



DOUBLE WASP engines power three of the most widely-flown aircraft types. Included are all models of the four-engined Douglas DC-6, all twin-engined Convair and Martin airliners. In airline and private commercial service throughout the world, these aircraft have achieved an outstanding record of dependability, efficiency and safety. Double Wasps now power over 32 per cent of all commercial airliners.

Pratt & Whitney Aircraft

MAIN OFFICE AND PLANT: EAST HARTFORD, CONNECTICUT • BRANCH PLANTS: NORTH HAVEN, SOUTHINGTON, MERIDEN
In Canada: Canadian Pratt & Whitney Aircraft Co., Ltd.

WITH THE DOUBLE WASP

SEVENTY-TWO AIRLINES, operating in every part of the world, depend on aircraft powered by Pratt & Whitney Aircraft R-2800 Double Wasp engines. Modern versions of the engine, like that pictured here, develop 2500 hp for takeoff. Double Wasps are standard for three of America's most widely flown aircraft types.

PRATT & WHITNEY AIRCRAFT
DEPENDABLE ENGINES

ONE OF THE DIVISIONS OF
UNITED AIRCRAFT CORPORATION

46 Major Projects at Lockheed

Advance Careers of Engineers

Lockheed projects cover virtually the entire spectrum of aeronautical engineering endeavor, including turbo-prop, turbo-compound and jet transports; jet fighters, trainers and bombers; vertical rising aircraft; nuclear applications to aircraft and many other significant classified activities.

It is the largest development and production program in the company's history, with 13 models already on assembly lines.

Diversification such as this offers engineers:

- More opportunity for promotion—because there are more high echelon positions to be filled on such a large number of projects.
- More career security—because Lockheed activities span so many phases of aeronautical effort.
- More stimulating work—because there is a wider range of assignments, because engineers have more scope for their ability, because a firm active on so many fronts of aviation welcomes and rewards fresh thinking, new ideas.

Generous travel and moving allowances enable you and your family to join Lockheed at virtually no expense to yourself. Lockheed Employe Service helps you get settled when you arrive.

Immediate Openings for: AERODYNAMICS ENGINEERS • AIRBORNE ANTENNA RESEARCH ENGINEERS • DESIGN ENGINEERS — at all levels in mechanical, electrical, hydraulic, power plant, controls and structures fields. • FLIGHT TEST ANALYSIS ENGINEERS • MATH ANALYSTS — to work on Lockheed's two 701 Digital Computers MICRO-WAVE SPECIALISTS—with at least three years' direct experience in an advisory capacity on airborne radar applications as well as a broad theoretical background and an advanced degree in Electronics or Physics • OPERATIONS RESEARCH SCIENTISTS • STRESS AND STRUCTURES ENGINEERS • STRUCTURES RESEARCH ENGINEERS • THERMODYNAMICS ENGINEERS • WEIGHT ENGINEERS.

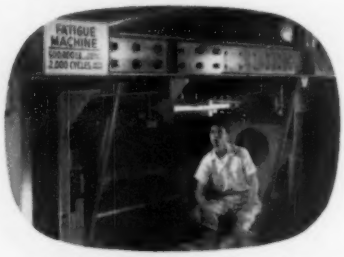
A report on "High Heat Treat Steel" taken from one of Lockheed's monthly engineering and manufacturing forums is available to interested engineers. Address requests to the forum chairman, E. H. Spaulding.

Engineers interested in Lockheed's expanding development and production program are invited to write to E. W. Des Lauriers, Dept. MP-3-8.

Below: Lockheed engineers at work on various projects

Operations Research study on overseas transport routes

Aerodynamic meeting on high-speed fighter



Fatigue test on Super Constellation skin

Antenna pattern study on radar search plane

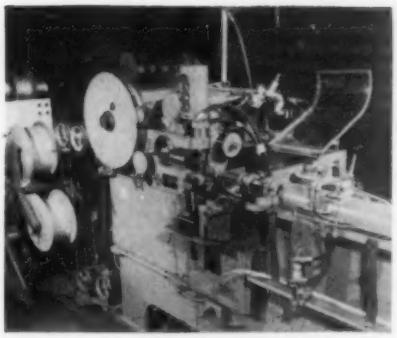
Design study on hydraulic requirements of new transport

Lockheed

AIRCRAFT CORPORATION

CALIFORNIA DIVISION • BURBANK

California



signed and built under an Air Materiel Command contract.

Annual dollar savings, based on wire production runs for jet fighter planes at North American, by one machine, used 40 hours a week are estimated to be $42,240.

The machine measures, numbers at both ends, cuts and end-strips multi-strand glass-braid and cloth single conductor wire. Changing from one order run to another takes about one minute, and from one gage to another about five minutes.

Artos Engineering Co., Milwaukee, Wis.

ALSO ON THE MARKET

M-6390 electro-magnetic clutch brake operates without slip rings or rectifier and is designed for use with 400-cycle 115-v. a.c. induction motors. Brake-holding torque is two pound-inches; clutch torque, two pound-inches, 11,000 rpm., four revolutions coast from this speed.—Units for larger motors and with ratings to 25 lb.-in. at 11,000 rpm., are being readied for future production. —Air Associates, Inc., Teterboro, N. J.

Midgetape is pocket-size battery-operated cartridge-loaded tape recorder. Maker says it has applications in small business aircraft or during flight tests of small planes. Price: $249.50.—Mohawk Business Machines Corp., 944 Halsey St., Brooklyn 39, N. Y.

Nitrogen charging valve has increased cross sections at critical working areas and is designed for 5,000-psi. working pressure and 20,000 psi, burst pressure. Valves have applications in landing gear, accumulators and similar purposes. —Superior Hydraulics Division, Superior Pipe Specialties Co., 15201 St. Clair Ave., Cleveland 10, Ohio.

Refrigeration cooling or heating units for electronic equipment are self-contained and centralized. Cooling and heating capacity is about 5,000 w.; ambient temperature range —85F to 160F; altitude range to 50,000 ft.—Eastern Industries, Inc., 100 Skiff St., Hamden 14, Conn.

Compression transfer machine boosts pressures and increases air or inert gas delivery rates from standard compressors. Model DV314 controls pressure with an accuracy of one-half of one percent.—Greer Hydraulics, Inc., New York International Airport, Jamaica 30, N. Y.

Voluta 23 quenching oil is said to have high oxidation stability and causes little smoke and flame during hardening operations. Item makes it possible to quench low carbon or low alloy steels in oil.—Shell Oil Co., 50 W. 50th St., New York 20, N. Y.

P-5 toggle clamp is a 10,000-lb.-pressure unit with a 2⅛-in. stroke.—Caddy Arc Welding Accessory Division, Erico Products, Inc., 2070 E. 61st Pl., Cleveland 3, Ohio.

Universal slicing machine for foam rubber, felt, insulation and similar materials has automatic winding feature. —Case-Maul Manufacturing Co., Mansfield, Ohio.

Portable cleaner uses high-velocity spray to clean electronic and electro-me-

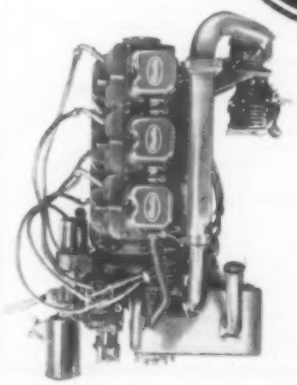
Still *First*

in commercial helicopter production . . .

the BELL 47G

. . . and still powered by

Franklin



4 out of 5 helicopters under 400 h.p. produced this year will have power by Franklin

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SYRACUSE, N. Y.

Smith, Kirkpatrick & Co., Inc., 46 Trinity Place, N. Y. 6,
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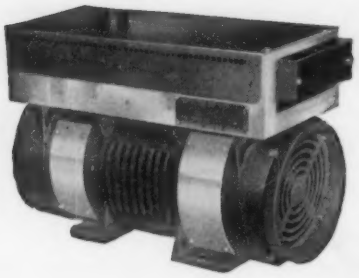
The most complete line of AIRCRAFT INVERTERS



Building inverters for regular and special aircraft needs is one of Bendix Red Bank's specialties. Thus, we offer the widest range of standard inverters plus the ability to design and produce all kinds of special-purpose inverters . . . including models up to 5000 VA and models for high-temperature, high-altitude applications. For complete details on inverters to meet your needs *exactly*, write Aircraft Inverter Section, Bendix Red Bank Division, Eatontown, N. J.

INVERTERS—400 CYCLE OUTPUT

Type	INPUT		OUTPUT			Approx. Weight Lbs.	Max. Alt. Feet	Designed to Government Part No.
	Volts	Amps.	Volts	Phase	VA Rating			
12128	27.5	1	26	1	6	2.2	35000	AN3496-1
12126	27.5	2	26	3	10	2.3	35000	N1020-SK
MG-93	27.5	12	115/200	1	100	10	65000	E-5134
				3	100			
MG-54	27.5	22	115/200	1	250	17	65000	E-5109
				3	250			
12142	27.5	22	115	1	250	13	35000	E-1617
				3	250			
12146-1	27.5	22	115	1	250	13	35000	53B6239
12146-2	27.5	22	115	3	250	13	35000	AN3532-2
MG-60	27.5	22	115	1	250	17	50000	53B6239
MG-62	27.5	22	115	3	250	17	50000	AN3532-2
32E01	27.5	35	115	1	500	26	50000	AN3533-1
				3	500			
32E00	27.5	37.5	115	1	500	34	50000	AN3534-1
		51.5		3	750			
MG-65	27.5	50	115/200	1	750	35	50000	E53805
		52		3	750			
1518 Mod. 1 & 2	27.5	105	115	1	1500	37.5	20000	—
		126		3	1800			
1518 Mod. 5	27.5	105	115	1	1500	37.5	35000	—
		126		3	1800			
MG-81	27.5	180	115/200	1	1600	61	65000	E1725
				3	1800			
32E06	27.5	150	115/200	1	2250	56	50000	E1725
		160		3	2500			
MG-70	27.5	170	115/200	1	2250	54	65000	—
				3	2500			
MG-61	27.5	170	115	1	2500	54	65000	53C6767
MG-64	27.5	170	115	3	2500	54	65000	—
32E03	27.5	160	115	1	2500	61	50000	53B6227
MG-95	27.5	150	115/200	1	2500	54	50000	E54807
		160		3	3000			
32E09	27.5	180	115/200	1	2500	60	50000	—
				3	3000			

NOTE: D.C. Input voltage shown is a nominal value of 27.5 volts, but all units are designed to operate from 26 to 29 volts. Input amperes shown are values at 27.5 volts input.

Manufacturers of Special-Purpose Electron Tubes, Inverters, Dynamotors, AC-DC Generators, Voltage Regulators and Fractional HP D.C. Motors.

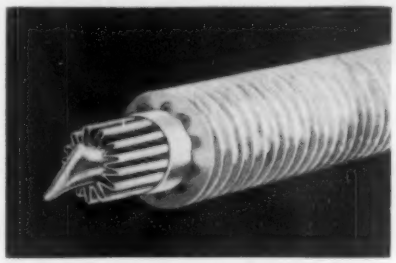
Bendix Red Bank — DIVISION OF — Bendix Aviation Corporation

EATONTOWN, N. J.

West Coast Sales and Service: 117 E. Providencia Ave., Burbank, Calif. • Export Sales: Bendix International Division, 205 East 42nd St., New York 17, N. Y.
Canadian Distributor: Aviation Electric Ltd., P.O. Box 6102, Montreal, P. Q.

chanical components. Unit micro-filters, heats and regulates compressed air to 80 psi., which is combined with a non-flammable, non-corrosive and non-polar solvent certified to military specs.—Cobehn, Inc., Caldwell, N. J.

Inner-Fin heat transfer surfaces are now applicable to a wide range of aviation heat transfer equipment, including air-to-air, liquid-to-air and liquid-to-liquid

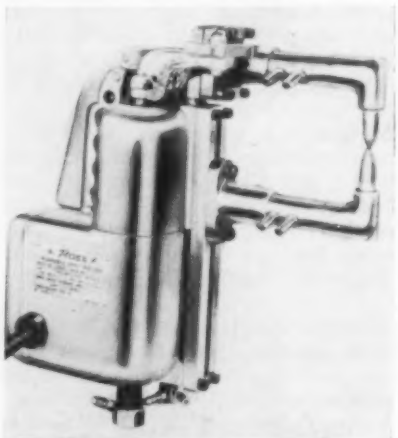


applications. Surfaces are said to provide greater outer surface and smaller hydraulic radius.—Bush Manufacturing Co., W. Hartford, Conn.

Aluminized fire rescue suit incorporates Scott air respirator that provides enough air for 15 min. work inside the suit.—Wheeler Protective Apparel, Inc., Chicago, Ill.

Vibration table for electronic tests has 5-60-cps. frequency range, 50-lb. maximum load and 0.2-in. maximum total amplitude.—Lance Products, P.O. Box 251, Forest Hills 75, N. Y.

Portable spot welder has built-in electronic timing control. Unit delivers over 17,000 amp. at point of weld.



Throat is 6 in., with 3 to 11-in. variable openings.—Ross Machine Tool Co., P.O. Box 122, Chicago Ridge, Ill.

Dorst super press for compacting powdered metal and ceramics has smooth toggle motion with fast approach to die cavity and final slow entry into die.—Arnhold Ceramics, Inc., 1 E. 57th St., New York 22, N. Y.

AVIATION WEEK

THE MAGAZINE OF AVIATION BUSINESS

ROBERT W. MARTIN, JR. PUBLISHER

A McGRAW-HILL PUBLICATION
330 WEST 42ND ST., NEW YORK 36, N.Y.

August 8, 1955

MEMORANDUM TO THE AVIATION INDUSTRY

The tremendous growth of aviation has created a whole new field of needed information services. Today, because of the great expansion of our industry, a publishing task of major importance is the establishment of our industry's first comprehensive annual buyers' guide with a circulation large enough to penetrate the industry's major purchasing influences, domestically and internationally.

November, 1955 will mark the publication of the AVIATION WEEK Buyers' Guide--an annual edition that will answer the long-felt demand of our industry's buyers, in civilian, Air Force and governmental capacities

Questionnaires are now being mailed to every manufacturer of record engaged in the production and supply of aeronautical products and materials. A year-round research group under editorial supervision has been established to seek out new products, new terminologies--to check and double check the accuracy of all information to be published--the availability and actual production of all items featured.

AVIATION WEEK's annual Buyers' Guide will establish a publishing service unique to our industry. It will be complete and comprehensive--with complete listing of all manufacturers of aeronautical and allied products--not just a token listing; correct and complete addresses; sufficient cross indexing to locate any product regardless of terminology . . . and most important, the Buyers' Guide format will provide, in one complete listing, a simple, easily used method of locating any product. In addition to these important details, the Buyers' Guide will have trade name and distributor listings. These are the factors of completeness--these are the essential features that will make AVIATION WEEK's Buyers' Guide a must for every aviation purchasing influence.

I am sure you will find this annual guide the No. 1 sales and merchandising opportunity for the year-round promotion and advertising of your products, materials and services.

Your AVIATION WEEK representative will gladly give you full details on advertising rates, mechanical specifications, closing dates or any other information that you may desire.

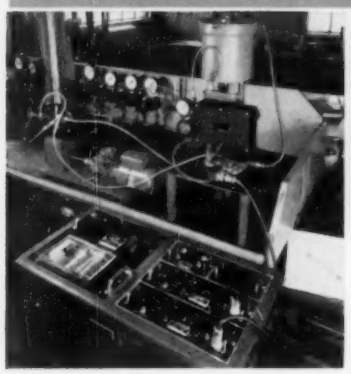
Very truly yours,

Robert W Martin Jr

Robert W. Martin, Jr.
Publisher

At the Mass. Institute of Technology Machine Tool Laboratory the effect of variables such as cutting fluid, tool geometry, speed and feeds, and tool material are measured and recorded, using a dynamometer and Sanborn two-channel System. Such records for various lathe operations, as well as many other cutting operations, provide valuable insight into the whole metal cutting process.

. . . from lathe cutting forces to telemetered aircraft data . . . SANBORN Oscillographic RECORDING SYSTEMS prove their versatility



At Moore Products input and response of their Valve Positioner, a pneumatic instrument widely used on diaphragm top-work valves and power cylinders, are recorded on a Sanborn two-channel System. Impulses from a pneumatic sine wave generator, of frequencies as high as 20 cps, are fed through a transducer to one channel, with valve stem response recorded by the second channel from a strain gage pickup.

At Edwards Air Force Base, California, this U. S. Air Force telemetering van received and recorded information transmitted from various pickups and transducers in the new delta wing Convair YF-102A during flight. Photos of van interior show eight Sanborn four-channel recording systems in rear, and close-up of four of the systems. Thus equipped, the van could receive data which would affect the design and performance of the YF-102A, a faster-than-sound, all-weather interceptor built by the Convair Division of General Dynamics Corporation.

These typical two- to 32-channel applications of Sanborn oscillographic recording systems give an indication of the tremendous scope of this versatile equipment. Elsewhere, Sanborn 1-, 2-, 4-, 6- and 8-channel systems and components are used in meteorological research . . . quality control programs . . . instrument and machinery field testing.

Flexibility of Sanborn design permits interchangeable amplifiers and preamplifiers to meet *individual* recording requirements with greater over-all efficiency and economy. Other Sanborn features include *inkless* recording in true rectangular coordinates, high torque galvanometer movement, time and code marking, and numerous chart speeds.

CATALOG AND TECHNICAL DATA AVAILABLE ON REQUEST

SANBORN COMPANY

INDUSTRIAL DIVISION
CAMBRIDGE 39, MASS.

Examiner Proposes New Routes in West

Continental, Western would get added key points in regional carrier victory over transcontinental lines.

By Craig Lewis

Washington, D. C.—Extensive new east-west routes for two regional carriers—Continental Air Lines and Western Air Lines—have been recommended by Examiner Ferdinand D. Moran in his report on the Denver Service Case.

A Chicago-Los Angeles route for Continental and a Denver-San Francisco route for Western are recommended by Moran. He also favors a Continental-Capital interchange at Chicago and removal of certain restrictions on American Airlines to permit expanded nonstop operations.

"Two conclusions with respect to the selection of carrier to operate the service found to be required are inescapable on the record," said Moran. "Only the selection of Western and Continental will provide regional-type service, and only the selection of Continental will contribute to a reduction of subsidy.

"When there is added the fact that in other respects Continental can, by an interchange with Capital, another regional carrier, provide additional through service to and from the east without extensive duplication and disrupting competitive balance, the selection becomes easy," he said.

Proposed Route Pattern

Here are the four recommendations:

- **Extension of Continental's Denver-Kansas City route** from Kansas City to Chicago and Denver to Los Angeles to give the carrier a Chicago-Los Angeles route. A restriction would stop Continental from operating through-plane service through Denver to points south of Denver (see next page).
- **Extension of Western's Minneapolis-St. Paul-Denver route** to San Francisco via Salt Lake City and Reno. Reno would only be certificated for three years and Western would be restricted from operating through-plane service between San Francisco and Reno, and points other than Denver north or east of Salt Lake City.
- **An interchange between Continental and Capital** to link the cities served by the two regional carriers.
- **Removal of restrictions on American** to permit unrestricted service between San Francisco and eastern points, operational stops at off-route points and nonstop service between Los Angeles and Detroit and other points further to the east.

The Denver Service Case is an investigation of air service to four air traffic centers that are located in the area between the Mississippi River and the West Coast.

Points involved are Kansas City, Denver, Salt Lake City and Reno.

The two largest points involved are served by monopoly carriers—United Air Lines at Denver and Trans World Airlines at Kansas City—in east-west operations. The basic issue involved is the need for competitive east-west service at each of the four points.

Regional Carrier Argument

The decision to pick Western and Continental for the new services hinges largely on the fact that they are regional carriers.

Services offered to the various points involved are largely designed as segments of transcontinental services. Planning of such flights for convenient schedules at their terminals often results in inconvenient schedules at such intermediate points as Denver and Salt Lake City.

The examiner finds a substantial community of interest among the four western cities and a need for competitive service between them. He finds the primary need is for regional service.

"The principal unsatisfied needs of Denver and the other cities are for local services," said Moran, "and considering the transcontinental duplication involved in the proposals of TWA, United and American, it appears that it would be more in the public interest if the required service were provided by one or more of the regional carrier applicants."

Selection of Continental is aimed at better service for Denver and Kansas City, not Chicago-Los Angeles terminal-to-terminal traffic, according to Moran. "Under this proposal," he said, "Denver and Kansas City would obtain advantages from competitive service without disrupting the present competitive balance between United and TWA, and the required service can be operated successfully apart from any operations involved east of Chicago. Continental estimates a reduction in its breakeven need of over $1,300,000, requiring approximately $610,000 less in subsidy and a reduction in total mail pay of $386,817 by the route extensions."

First Competition

The examiner's report points out that the proposed route for Continental would institute the first competitive service between Denver and Los Angeles, Kansas City and Los Angeles, and Denver and Chicago.

In reference to the proposed interchange, Moran said: "Capital and Continental need the traffic support which the interchange between the two carriers would provide. In sharp contrast to the strong transcontinental carriers, Capital and Continental are short-haul regional carriers, and their operations are dependent upon the local passengers moving in their regions, plus their limited access to through passengers traveling by inter-carrier connecting service."

The interchange would offer Kansas City and Denver the first competitive service to New York, Cleveland, Detroit and Washington. Kansas City would have its first competitive service to Pittsburgh and first one-plane service to Norfolk, Va. Denver would get first competitive service to Chicago and first one-plane service to Pittsburgh and Norfolk.

The selection of Western for the Denver-San Francisco route closes a

Record UAL Profits

United Air Lines reports record net profits of $4,272,080 for the first half of this year, nearly doubling the $2,473,066 reported for the same period of 1954. Earnings equalled $1.52 per share of common stock, compared with 81 cents a year ago.

Operating revenues increased 28% to $111,584,236, while operating expenses climbed 22½% to $101,744,397.

Traffic gains included: 1,870,968,368 revenue passenger-miles, a 30½% increase; 12,938,778 mail ton-miles, a 22½% climb; 5,615,025 express ton-miles, gaining 26½%, and 19,555,896 freight ton-miles, up 28½%.

Mail revenue for the first half declined because of the government's 20% reduction in United's mail rate, cut from 45 cents to 36 cents per ton-mile. UAL estimates that revenues for the six-month period would have been $1,009,000 more if this reduction had not been made.

gap in Western's system and integrates logically with the carrier's routes since Western serves the area traversed by the new route. The report finds that authorization of Western would not divert a significant amount of revenue from any carrier with the exception of United, and that the diversion from United would be less than that of any other carrier in the case. Western would provide a greater amount of new one-carrier service in relation to duplicating service than any other applicant.

Lifts American Restrictions

Moran also points out that Western is the smallest of the nonsubsidized trunklines and the new route will strengthen its system since the carrier depends on a few high-density routes to support unprofitable operations at the numerous small traffic points on the system.

Several restrictions on American's transcontinental routes would be removed under the examiner's recommendations. Currently, American must make one stop at Tulsa, Dallas or a point west of those cities on flights between San Francisco and points east of Tulsa or Dallas on Route 4. Services between San Francisco and eastern points on routes 7 and 25 must observe this routing, but must make two stops.

The report recommends removal of the restrictions to allow American to operate nonstop flights between San Francisco and Chicago, New York, Boston, Washington and other eastern points.

Moran also recommends American be permitted to operate nonstop between Los Angeles and Detroit and other eastern points.

A restriction on American's transcontinental route which prohibits off-route operational stops would be lifted by the examiner. This move would permit more efficient routing and dispatching on transcontinental flights.

Continental Plans on Jet Airliners For Los Angeles-Chicago Route

Continental Air Lines plans to operate Lockheed Electras, Douglas DC-8s or a commercial version of the Boeing 707 between Los Angeles and Chicago by late 1958 or early 1959 if the Civil Aeronautics Board approves its certificate for the new route. As interim transports, CAL will pick up its option on 15 turboprop Vickers Viscount 800s or buy Lockheed 1049G Super Constellations.

The airline expects to spend more than $40 million on new equipment for the proposed Los Angeles-Denver-Chicago route, recommended for Continental by CAB Examiner Ferdinand D. Moran.

Leading Contenders

Last week, CAL President Robert F. Six appeared to favor Electras or DC-8s over a Boeing jet airliner and Viscounts over the piston-engined 1049G. He met in San Francisco with members of the carrier's board of directors to work out the $40-million re-equipment program and then continued on to Los Angeles for talks with Lockheed Aircraft Corp. and the Douglas Aircraft Co. His schedule did not include a trip to Seattle for negotiations with Boeing Airplane Co.

On Sept. 4, Six will fly to Britain with Capital Airlines President J. H. Carmichael and J. B. Franklin, CAL vice-president of operations, for a second look at the Viscount and to reopen talks with Vickers-Armstrongs. He first inspected the medium-haul airliner in England last May and took an option on 15 of the 800s.

If Six settles on the Viscount, he will match the turboprop transports now being put into service by Capital and will set up possible one-plane coast-to-coast service on Continental's proposed interchange with CAP at Chicago.

Delivery of CAL's Viscounts would start in mid-1956.

Expansion Program

Jet and interim transport orders will follow closely on the heels of an expansion and re-equipment program that includes a new $7-million hangar and office building revealed last week and $10 million laid out in April for three Convair 340s and five Douglas DC-6Bs.

Continental will build the new structure on a 34-acre site at its Stapleton Airfield headquarters in Denver. Construction is scheduled to begin late this fall, with completion set for early in 1957.

Announcement of plans for the building came shortly after the CAB announced Examiner Moran's route recommendations. Continental spokesmen said the structure is not contingent on final Board approval of the new route but admitted that construction may be slowed and the $7-million project broken into stages if the examiner's ruling is not approved.

As planned, the new headquarters will include a two-story brick, concrete and limestone office building with 107,500 square feet of space. A hangar will have 159,000 square feet of space, enough to house six DC-6Bs and four Convairs plus 97,500 square feet for shops and maintenance units.

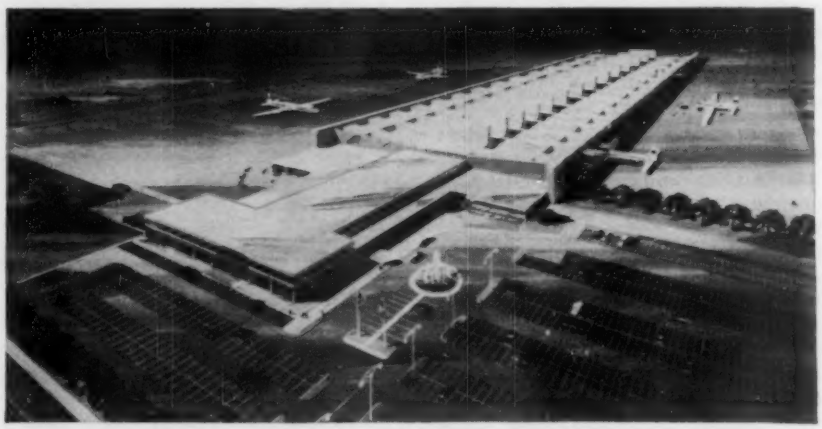
Actual cost of the building will be $5,714,670, with the balance going for engineering, architectural work and design and financing.

Continental's five new DC-6Bs will be delivered in April, 1957, and put into service on the airline's present major routes—Denver-Kansas City, Kansis City-El Paso and Denver-El Paso. Convairs will be taken over early next year and operated on the local service routes in Texas that CAL obtained when it absorbed Pioneer Air Lines.

PAA's Airfreight Up

Pan American World Airways' trans-Atlantic airfreight volume increased to 2,958,000 lb. during the first half of 1955, a 39% gain over the same period last year.

To handle the new business, PAA added a fourth all-cargo flight to its weekly schedule.



CONTINENTAL'S NEW $7-MILLION headquarters, to be built at Denver's Stapleton Airfield, is shown in this artist's sketch. Unusual hangar (upper right) allows for expansion.

Airborne Radar Speeds Panagra Flights

By G. J. McAllister

Buenos Aires—Pan American-Grace Airways is anticipating greater schedule stability and increased aircraft utilization through installation of airborne radar in its DC-7B and DC-6B fleet for Latin American operations.

Effectiveness of the Bendix RDR-1 radar system was demonstrated last week in the pre-inaugural flight of Panagra's DC-7B El Inter Americano flight from New York to Buenos Aires and return. The 11,066-mile trip was covered without discernible turbulence although the roundtrip flight passed over some of the world's most rugged terrain and areas of unpredictable storm areas. The return flight was made in 20 hr., 2 min., a new commercial record. Actual flying time was 18 hr., 2 min. This is 3 hrs. faster than the previous best time.

First airline to order and use commercial radar in scheduled service, Panagra is equipping its new fleet of 5 DC-7Bs and its 5 DC-6Bs with the RDR-1 radar which operates in the "X" band (3.2 cm.).

Panagra Vice President and General Manager Douglas Campbell pointed out these advantages:

- **Scheduled reliability.**
- **Passenger appeal.**
- **Maintenance savings.**

One of the major difficulties of South American flight operations is the uncertainty of weather conditions, particularly at night. A permanent weather front exists along Panagra's route from Panama to Lima. In addition, pilots are unable to discern at night storm centers that crop up suddenly. Unless a storm center is discharging lightning, there was no way of knowing whether a storm ahead is on the aircraft's course. One mountain in the Andes range towers to 23,000 ft.

Pilots were forced to slow down speed and feel their way through turbulent areas. Schedules were uncertain.

"Airborne radar is one of the finest advancements made in recent years for commercial flying both from the passenger and pilot viewpoint," Capt. Ernest B. Hummel, a Panagra pilot for 15 years, told AVIATION WEEK.

Panagra is plugging airborne radar heavily in its promotion of the luxury DC-7B and tourist DC-6B flights from Miami to South America.

Plane Damage

"The airborne radar should dispel those few remaining doubts of potential airline customers concerning the safety of flight," says Edward G. Bern, Panagra vice president for sales and traffic.

Severity of storms has caused extensive structural damage to aircraft in South American service, requiring a complete overhaul before they can be used in commercial service again. Even relatively minor disturbances may inflict sufficient damage to keep an aircraft out of service for a week or two.

Panagra is proud of its 13 years of fatality-free operations, a record they feel can be maintained with the use of airborne radar.

The carrier conducted a year of evaluation tests with an APS-42A system in one of its DC-6Bs before a decision was made to equip its DC-7Bs and DC-6Bs.

Panagra selected the "X" band because it best suits its operations. The "X" band works better in accurately defining storm areas in the immediate area. "C" band radar has a greater penetration.

Operation of weather radar system depends upon the fact that water particles, either suspended in a cloud or as rainfall will reflect a radar beam to an extent dependent upon the concentration of the moisture.

Simple Scope Presentation

A pilot with a minimum amount of training can assimilate weather information quickly because of the planned position indicator (PPI) scope presentation, called iso-echo contours. The position, intensity and extent of the storm cells can be judged quickly and a decision made whether to fly around or through a storm area can be made with confidence.

The contour presentation gives an indication of the location of severe turbulence by noting the rate of change of rain intensity. The rate of change is highest, and the turbulence greatest where the lighted ring surrounding a dark area is thinnest. These are the regions to be avoided.

The Bendix system produces a pencil beam which is stabilized for the roll and pitch of the airplane. Maximum range of the system is 150 miles. A switch on the indicator permits a display of ranges of 20, 50 or 150 miles.

The radar scans an angle up to 120 deg. to either side of Panagra's DC-7B during flight and it is possible to tilt the beam to examine other altitudes or for general terrain mapping purposes.

On the return flight of Panagra's El Inter Americano, it was possible to watch the terrain of the Andes unfold as the flight proceeded from Buenos Aires to Lima. The RDR-1 also has provisions for ground beacon navigation.

Capt. Hummel demonstrated to AVIATION WEEK how the pilot can fly the plane at night while the DC-7B is on automatic pilot. The pilot views the weather ahead through the simply-designed radar scope and is able to maneuver the DC-7B with the Sperry A-12 automatic pilot which can make a controlled turn without losing altitude.

Total weight of the RDR-1, including antenna, indicator, synchronizer, transmitter-receiver and control unit, is 141½ lb.

Penalty Plan Sought For No Show Fares

Industry agreement on a penalty system for no shows and late reservation cancellations will be sought by the domestic scheduled airlines at a special Air Traffic Conference meeting to be held in Chicago this week.

ATC members will consider a penalty plan proposed by a special seven-member committee appointed when agreement could not be reached at the semi-annual meeting last May in Boston (AW May 16, p. 19).

The plan's major points:

- **If a passenger does not show,** he will be charged 20% of the fare for the first leg of the trip, with a $2 minimum.
- **If a passenger cancels or changes his reservation** less than six hours before scheduled departure, he will be assessed 10%, with a minimum of $1.
- **If a passenger has confirmed space** he will be required to pick up his ticket seven days in advance or by 3 p.m. of the next day, whichever is earlier.

Whatever final form a penalty plan may take, the airlines are certain to establish a system for combatting growing abuses.

Industry officials report that no shows have increased from 50 to 60% since the discredited reconfirmation rule was dropped on June 15. At the same time, there has been increasing concern over late cancellations.

Fresh Air for Swissair

Swissair is equipping its entire fleet with a new air-freshening device which is said to remove all tobacco and food odors, decreasing the possibility of airsickness (AW July 25, p. 123). When the device is installed, cigar smoking will be permitted for the first time on Swissair flights, the airline says.

The new aid to flight comfort is a small metal cylinder containing fiber glass impregnated with P-6, a hydrocarbon which has the property of causing odor-forming substances to precipitate out of the air, leaving the atmosphere fresh. The cartridge treats the air as it is moved past by the plane's air conditioning system.

American Disputes Viscount Data

Performance capabilities of the Vickers turboprop transport, which Capital Airlines' put in service last month, have been challenged by American Airlines during the New York-Florida Route Case before the Civil Aeronautics Board. Both of the carriers are involved in the case.

CAB Examiner Thomas Wrenn, at the request of American attorney John Douglas, has subpoenaed J. H. Carmichael, Capital's president, to produce Vickers performance data for consideration at the hearings.

Douglas made his subpoena request with the charge that Capital's New York - Washington - Miami Viscount schedules proposed in the Florida case were in excess of the manufacturer's claims for the Viscount and "entirely unrealistic." It was pointed out that the schedules gave times equal to those for the Douglas DC-7.

In a previous request for the Capital Viscount specifications, Douglas drew a promise from Carmichael that Capital would furnish the performance data on which it based the Viscount schedules in the Florida case. When he asked for the subpoena of Carmichael, Douglas said the data had not been produced in three weeks time.

Carmichael was scheduled to deliver a copy of all the specifications relative to the performance of the Viscount 700-D transport equipped with the Rolls-Royce Dart 506 and/or 510 engine that had been received from Vickers-Armstrongs, the Viscount's manufacturer, up to Mar. 18, 1955.

Viscount Traffic Gains

Capital Airlines reports an average passenger load factor of 82% for the first 10 days of scheduled service with the Viscount turboprop transport. Since Capital inaugurated Viscount service July 26, the lowest load factor for the turboprop has been 73% and the highest 91%. This compares with load factors ranging from 45% to 75% with Constellation service over the same runs.

North American Wins Reprieve

North American Airlines has been granted a short reprieve from the terms of a Civil Aeronautics Board decision to order the carrier out of business (AW July 11, p. 107).

The Board has now postponed the effectiveness of its order to give North American an opportunity to ask for judicial review.

CAB postponed revocation of the operating authority of the irregular carrier group until 30 days after a Court of Appeals decision if the Board order is confirmed.

The cease and desist provisions of the CAB order are now postponed until Aug. 30.

Postponement of the cease and desist portion of the order allows North American to continue its present operations and gives the carrier an opportunity to seek a further stay from the Court of Appeals.

The Board said it postponed the effectiveness of its orders in the North American compliance case in recognition of the irregular combine's right to seek judicial review. In its postponement order, CAB made clear that it continues to feel that North American's operations are in direct violation of the law.

North American drew some support from Congress in its fight with CAB in the closing day of Congress. Several congressmen urged the House Interstate and Foreign Commerce Committee to investigate CAB policies, especially those relating to irregular carriers and the right of entry into air transportation.

In a speech on the House floor, Rep. Chet Holifield (D.-Calif.) said he feels that "there is no question but that there has been a violation of the Civil Aeronautics Act, but I am not certain as to who has been the violator, considering the economic hobbles laid down by the CAB.

"There may be a technical violation by the North American Airlines, but in terms of the broad interests of the CAA act, we have prima facie evidence that the Board has flouted the interests of Congress and clearly perverted its power to foster a government-protected monopoly by courtesy of the federal government."

In another House speech, Rep. John Rooney (D.-N. Y.) predicted that elimination of North American will result in airline fare increases.

He also accused the major American airlines of resisting any investigation of fares and said that competition by North American is all that stands in the way of fare hikes.

North American reports June traffic of 40,847,682 passenger-miles was up 47% over the previous June. Traffic for the second quarter of 1955 was 66,063 passengers and 111,584,016 passenger-miles.

This compared with 45,771 passengers and 73,165,569 passenger-miles in the same period last year. Gross revenues for the period were $4,059,907, up approximately 65% over the second quarter of 1954.

CAB Will Not Expand 2 Interchange Cases

Civil Aeronautics Board has refused to open a general investigation of air service between the south and the west in refusing requests for expansion of two Texas-California interchanges cases.

The prospect of a duplicate of the long, bitter southern service to the west case arose when CAB began consideration of the renewal of a Braniff Airways-Trans World Airlines interchange at Amarillo, Tex., and a Continental Air Lines route segment between Houston and San Antonio. The continental segment is a part of a Continental-American Airlines interchange between Houston and California.

When the interchange case opened, Eastern Air Lines asked the CAB to expand it to a general investigation of service between the south, Texas and California. CAB asked that Texas-California route proposals be included.

Several airlines objected to expansion of the case, but asked to be included if it was expanded. CAB has decided to limit the case to the interchange issues.

CAB Member Josh Lee disagrees with the majority decision. Lee points out that American Airlines dominates Texas-California service and that four interchanges from the south to California use American's route from Texas to the West Coast.

Lee says that "the majority is apparently unwilling to try the issue of competitive service between Texas and California.

"I think it is a great mistake to protect any monopoly at the expense of the public interest."

Tower Hazard Studied

A special working group to study the conflict between aviation and radio-television interests in the use of air space was created last week by the Joint Industry-Government Tall Structures Committee.

The seven-member fact finding group, appointed by Civil Aeronautic's Fred B. Lee and Federal Communications Commissioner Robert E. Lee, co-chairmen of the group was directed to make its report by Sept. 15.

The new working group is specifically charged with finding ways to reduce the aircraft-tower collision hazard. It will consolidate the early efforts of two aviation and radio-TV fact finding groups which were at odds with each other in their final reports to the committee.

CAB ORDERS

(July 21 to July 27)

GRANTED:

Purdue Aeronautics Corp. An exemption to perform two roundtrip charter flights between Chicago, Ill., and Kenora, Ontario, Canada, pursuant to agreements with Brown-Forman Distillers Corp.

Transocean Air Lines an exemption to perform one charter flight from New York to Prestwick, Scotland, carrying 33 people from Western State High School, Kalamazoo, Mich.

North American Airlines, Trans National Airlines, Trans American Airways, Hemisphere Air Transport, Great Lakes Airlines, Currey Air Transport, Aero Finance Corp. and Peninsular Air Transport leave to intervene in the ACTA-IMATA commercial charter exchange investigation.

Air Line Pilots Assn. and the International Association of Machinists leave to intervene in the Eastern-Colonial acquisition case.

Flying Tiger Line an exemption to perform ten flights in August and eight flights in September to New York from London, Paris, Brussels, Bremen, Hamburg, Munich, Milan, Rome and Athens pursuant to a contract with the Intergovernmental Committee for European Migration.

Continental Air Lines exemption authority to operate between Houston and Austin, Tex., without restriction for one year.

Louisville Chamber of Commerce leave to intervene in the Louisville-New York non-stop air service investigation.

APPROVED:

Resolutions between various carriers adopted by the International Air Transport Assn. relating to Class-B fares between Athens and Istanbul.

Interlocking relationships between Harold B. Seifert and Robert J. Smith and Continental Air Lines, Pioneer Air Lines and Pioneer Aeronautical Services.

Agreements between Eastern Air Lines, National Airlines and various other carriers relating to inter-carrier arrangements.

Agreement between Slick Airways and Airwork Limited which provides that Airwork furnish crews for aircraft leased from Slick.

Resolutions between various carriers adopted by the International Air Transport Assn. relating to special tourist fares for travel by Heron aircraft between certain points in the United Kingdom and Hamburg and Copenhagen.

ORDERED:

California Air Charter's letter of registration suspended for failure to file required reports, unless the carrier files the overdue reports by Aug. 10.

Pan American-Grace Airways' temporary mail rate set at the rate proposed by the Board in its show cause order for the period starting Jan. 1, 1955.

Effectiveness of the certificates issued in the States-Alaska Case stayed until Aug. 26, 1955, while the Board considers petitions for reconsideration.

Frontier Airlines to show cause why the Board should not set a temporary mail rate for the period starting Sept. 15, 1954, designed to provide annual mail pay of $2,281,453.

DISMISSED:

Capital Airlines' complaint against joint fares filed by New York Airways and Northwest Airlines. The CAB investigation is also dismissed.

Slick Airways Pilots Assn.'s petition for rehearing of the case involving approval of the Slick Airways-Airwork crew substitution agreement.

Air France 1049Gs

Paris—Air France will put the first Lockheed 1049G Super Constellation of six on order into North Atlantic service this month. The other five will be delivered by September, bringing to 15 the total number of 1049Gs in Air France's trans-Atlantic fleet.

The new transports will be used to replace 1049Gs now in operation, which in turn will replace 749G Connies used on routes in French West Africa and French Equatorial Africa.

With its present equipment, Air France carried 780,000 passengers during the first six months of 1955, a 19% increase over the same period last year. Ton-kilometer capacity rose 3.5% during the year's first half and ton-kilometers flown gained 8%, giving a load factor of 71% against 68.5% in the first six months of 1954. Passenger-kilometer capacity remained the same as in 1954 but passenger-kilometers flown increased 12%, giving a load factor of 67%.

SHORTLINES

▶ **Great Lakes Airmotive, Inc.,** Ypsilanti., has been licensed by the Canadian Air Transport Board for non-scheduled charter operations between Willow Run Airport, Mich., and points in Ontario and Quebec. The authorization is for three years, with aircraft having a maximum load limit of 6,000 lb.

▶ **LACSA, Costa Rican airline,** can now make traffic stops at San Salvador, El Salvador, under a reciprocal agreement between the two governments. Formerly, LACSA could make fueling stops only at San Salvador on its San Juan, Costa Rica-Mexico City Convair 340 service.

▶ **KLM Royal Dutch Airlines** plans to start construction of the world's largest hangar in early fall at Schiphol Airport, Amsterdam. The hangar is designed to accommodate seven DC-6 or DC-7 aircraft, plus offices, stores, a canteen and workshop.

▶ **Puerto Rico's** San Juan Air Terminal was used by 592,029 passengers in the year ending June 30.

▶ **American Airlines** and KLM Royal Dutch Airlines are offering joint air cargo service, with reserved space on the trans-Atlantic carrier's DC-6As.

▶ **Rhein-Main Airport** in Frankfurt, Germany, is planning a high-speed railway connection between the city's business district and the airline passenger terminal at the field.

▶ **Seaboard & Western Airlines'** commercial freight ton-miles totaled 5,925,447 during the first half of 1955, a 41% increase over the same period last year. The overseas air cargo carrier completed 6,406 ocean crossings from the start of operations in 1945 to the last day of June, 1955.

▶ **Trans World Airlines** and **Eastern Air Lines** tied their teletype communications circuits together Aug. 1 to speed interline reservations service.

▶ **Lake Central Airlines** boarded 10,562 passengers in June, a 45.8% increase over the previous June. Load factor was 38.75% compared with 31.36% for June, 1954.

▶ **Los Angeles International Airport** reports traffic for the first five months of 1955 up 25.4% over the same period last year. Air mail traffic was up 18%, air freight up 22% and air express up 30%.

▶ **Silver City Air Ferry** has carried 131,500 vehicles and 336,500 passengers across the English Channel since service started seven years ago.

▶ **Slick Airways** has started scheduled airfreight service to the Washington-Baltimore area from the midwest, Texas and the West Coast.

▶ **Swissair** carried 56% more freight across the Atlantic in the first half of 1955 than it did in the same period last year.

▶ **Trans World Airlines** adds two transcontinental schedules with Super-G Constellations Aug. 1 between New York and Los Angeles.

▶ **United Air Lines** will expand its facilities at Seattle-Tacoma airport in a $1,000,000 program which includes a new flight kitchen and a hangar addition.

▶ **Western Air Lines** has inaugurated service at Sioux Falls, S. D., on routes between Minneapolis-St. Paul and Salt Lake City and Denver.

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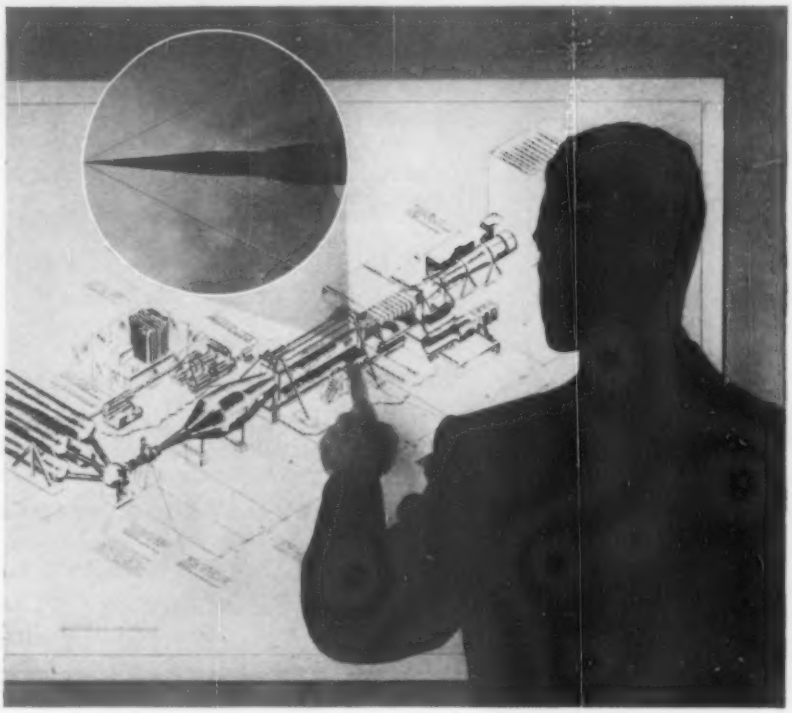

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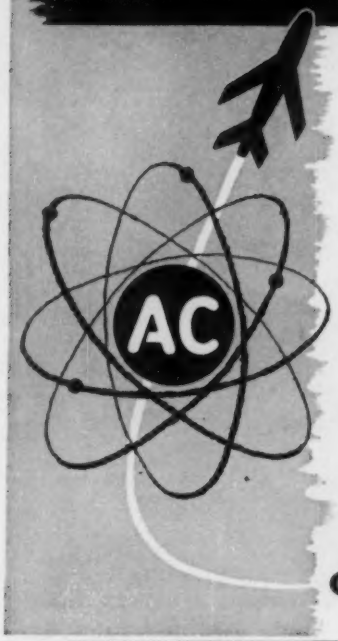

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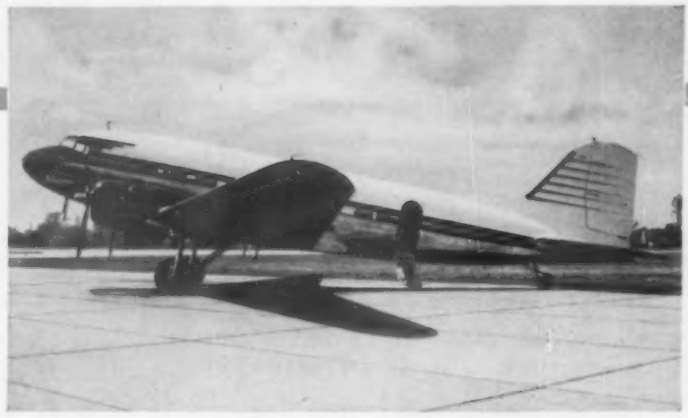

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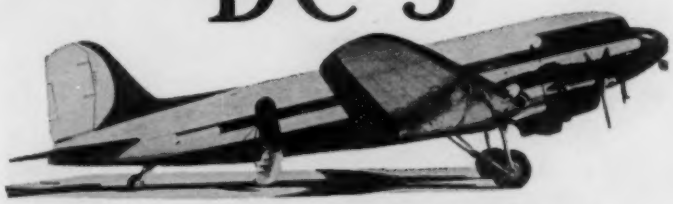

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EDITORIAL

The Air Traffic Control Problem

The steadily increasing density of air traffic is a grave problem facing both civil and military aviation. Air traffic already has badly overloaded the federal airways system, and its rate of growth is outstripping the pace of technical and political progress in developing new and more efficient traffic control methods.

This traffic snarl poses these serious threats to civil aviation:

• **Further restriction** of civilian private flying such as the high density traffic zone recently established in the Washington, D. C., terminal area.

• **Economic limitation** on the growth of airline revenues because of the inability to move more aircraft in and out of heavy traffic terminals, particularly in bad weather.

Air Defense Hazard

For the military, air traffic control limitations now interfere with and seriously hamper efficient performance of Air Defense and Strategic Air Commands' missions. For example, many all-weather jet fighters defending New York City have to "scramble" 70 miles out to sea at low altitude before they can do a maximum climb to intercept altitude in order to avoid a heavily-traveled federal airway. The heavy volume of military training and of off-airways flying now makes it necessary to control traffic in large areas and not just along the narrow airways bands.

For both military and civil aviation, the combination of increasing traffic and a DC-3 era traffic-control system create a terrible safety hazard. Mid-air near misses are becoming more frequent. Air Transport Association ran a "near-miss" survey for several months recently and found airline pilots reporting an average of four "near misses" daily.

Not long ago two Strategic Air Command B-47 formations combed through each other inadvertently at night in a head on pass. In the gloom and at the 1,200 mph. closing speed, the formations had no warning. Only extreme good luck prevented anything more serious than bent jet engine pods and clipped tail fins.

Airline pilots flying on VOR radials, 15 degrees apart, have found themselves on collision courses when approaching terminal areas.

There appear to be three trends that offer some immediate improvement in air traffic control safety and efficiency:

• **Increased use of radar,** both for large area and en route control, as well as in the final approach zone. The integration of USAF's air defense radar system and the development of a joint military-civil airborne radar transponder will do much to speed efficient radar traffic control.

• **Better air-to-ground communications.** The VHF frequencies are badly clogged now. With the high approaches of modern transports, it is not unusual for an airline pilot trying to contact Washington approach control to be blocked out by transmissions on the same frequency at Cleveland. Remote VHF stations, as now used in the New York area, are a help, but it seems likely that the airlines will have to give up many of their company radio frequencies to alleviate this problem. Military conversions to UHF also will help.

• **Better altimeters** for both military and civil aircraft. At the 40,000-ft altitudes where military jets operate, pressure altimeters are not sufficiently accurate. On civil aircraft at lower altitudes the varieties of pressure points, depending upon the terrain, for altimeters produce cockpit instrument variations that further complicate the altitude separation problem.

Action Urgently Needed

But even more acute than any of these specific points is the need for a unified approach to modernizing the federal airways system and to backing the best technical developments available. The establishment and operation of the federal airways system is the legal responsibility of the Civil Aeronautics Administration. In the post-war years, the CAA airways operations have drifted in twin currents of technical obsolescence and bureaucratic lethargy.

What little progress was made usually came only after military and airline prodding. A much more vigorous approach to the grave problem of air traffic control is necessary now if aviation is to avoid the tragic consequences of more mid-air collisions, economic strangulation of airline revenues and blunted efficiency of Strategic Air Command and Air Defense Command operations.

—Robert Hotz

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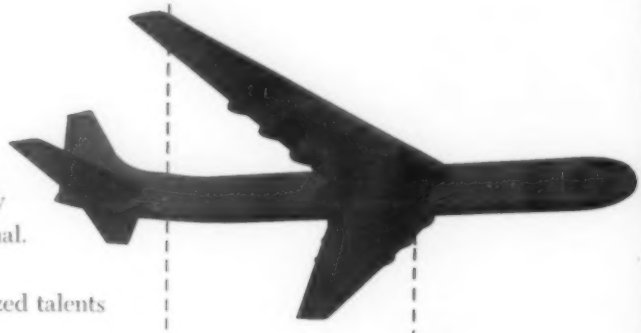

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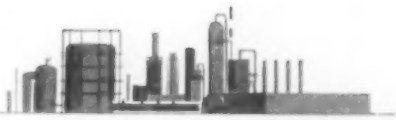

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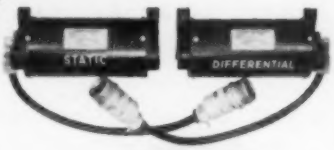

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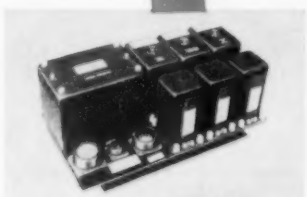

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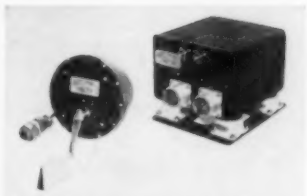

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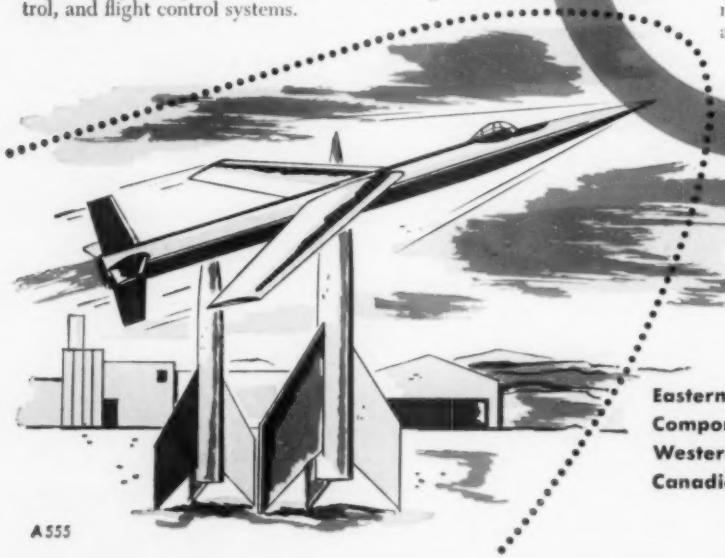

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